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WATER QUALITY INITIATIVE MONITORING PROGRAM

Water Quality Report 2010

RiverStone
Environmental Solutions Inc.

WATER QUALITY INITIATIVE

2010 Water Quality Report

Prepared for: Muskoka Lakes Association

January 19, 2011

RiverStone Environmental Solutions Inc.

RIVERSTONE
ENVIRONMENTAL SOLUTIONS INC.

January 19, 2011
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SUBJECT: Muskoka Lakes Association Water Quality Initiative – 2010 Water Quality Report

Dear Eleanor:

RiverStone Environmental Solutions Inc. is pleased to provide you with the attached 2010 Water Quality Report.

Please contact us if there are any questions regarding the report, or if further information is required.

Best regards,

RiverStone Environmental Solutions Inc.

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Executive Summary

The Water Quality Initiative (WQI) is a science-based monitoring program established by the Muskoka Lakes Association (MLA). It has just completed its tenth year. The WQI program collects valuable data alongside local water quality programs run by other agencies. Since 2009, the MLA has collaborated with RiverStone Environmental Solutions Inc. (hereafter RiverStone), a local environmental consulting company, for scientific guidance, technical support, and the development of plans for Stewardship Initiative Groups based on local interests.

In 2010, the WQI program volunteers sampled 189 sites over 45 sampling areas throughout the District Municipality of Muskoka (DMM) and the Township of Seguin. Bacteria measurements were made at 139 sites, spring turnover phosphorus measured at 43 sites and nearshore phosphorus measured in 22 sampling areas.

In this Water Quality Report, the results of the 2010 WQI monitoring program are presented using area summary pages. The summary pages present area-specific information in a condensed format in the following sections: a visual and written area description, volunteer recognition, summary of the 2010 data, trends, and comments and recommendations. Graphs illustrating long-term spring turnover and yearly mean phosphorus concentrations, and long-term total coliform and *E. coli* yearly means are included in each summary. Separate from this report, the 2010 "Program Delivery & Methodology" document, found on the MLA website, provides a detailed description of program implementation and scientific methods.

In general, data collected for the 2010 WQI program indicate that the monitored lakes have consistently good water quality that is suitable for recreational use, whether described by bacteria or nutrient status. There also appears to be a general downward trend in both total phosphorus and *E. coli*, based on the MLA's past last three years of sampling. Where applicable, total phosphorus concentrations measured at nearshore sites were compared to measurements from deepwater reference sites. Data analysis revealed that land-based influences on nearshore phosphorus were only detectable at sites located in close proximity to creek outlets. This confirms the results of the long-term data analysis completed in the 2009 WQI Monitoring Program Technical Report (RiverStone, 2010). These results also suggest that land-based phosphorus point source detection within watercourses may require a more intensive, site-specific sampling regime.

In terms of comparing the MLA's 2010 spring turnover data, to data and threshold values provided by the DMM, this is done by sampling area on the summary pages. It is anticipated that the DMM will begin its lake remodelling exercise in 2011 using Muskoka's Recreational Water Quality Model and new data from its Lake System Health Monitoring Program. Recent discussions with the DMM suggest that it is possible that a number of lakes/areas that were not specifically modeled could be identified jointly by the MLA and DMM using historic MLA data. These areas may be modeled in the next couple of years. The MLA is well-positioned to provide valuable input into this process, given the wealth of water quality data it has collected over the past 10 years.

The WQI has allowed members of the lake communities to take an active role in monitoring water quality in their neighbourhood(s). Stewardship Initiative Groups can and have used the monitoring data as the foundation for developing more detailed studies and as a basis for discussions with local governments on how to best protect our lakes and recreational water quality for the future. Based on the analysis of the MLA's 2010 data, a number of new areas have been recommended for consideration to be targeted for the development of more detailed studies in 2011. These include Windermere, Muskoka Sands and the Indian River.

The general recommendations for 2011 include the continuation of the training sessions with more emphasis on the bacterial methodology, continued use of a Field Coordinator to support volunteers and review data promptly, continued use of Stewardship Initiative Groups, and continued interaction with government to facilitate more knowledgeable involvement in lake health.

In terms of the collection of data for 2011, RiverStone suggests the following.

1. Continue monitoring all deepwater reference sites for spring turnover and yearly mean phosphorus.
2. Select new bacteria sampling sites, removing those sites where no evidence of elevated bacteria has been noted over the past 3 years of sampling.
3. Select some nearshore reference sites to monitor as part of a long-term phosphorus monitoring program. Discontinue the sampling of any nearshore sites where land use influence was not detected and select new sites to sample based on volunteer input or as part of a detailed study design.
4. If a research component is desired as part of the MLA WQI program then consider the development of a new research theme focussing on late summer deepwater phosphorus or dissolved oxygen.

Table of Contents

List of Area Summaries

1. INTRODUCTION

The Muskoka Lakes Association (MLA) has been conducting a water quality monitoring program since 2001.The program has grown each year, with the 2010 program having 189 sampling sites in 45 sampling areas across the District Municipality of Muskoka (DMM) and Seguin Township. The monitoring program has been made possible through the dedicated efforts of many volunteers engaged in data collection and management, and program administration and development. RiverStone Environmental Solutions Inc. (hereafter RiverStone) has provided scientific and technical support since 2009. Again, we extend our congratulations to all of those dedicated volunteers that contribute to the program: this would not be the program that it is without you!

The MLA elected to condense the Water Quality Report for the 2010 Water Quality Initiative (WQI) into one document. The 2010 Water Quality Report has been prepared to provide a general outline of the initiative, summaries for each of the sampling areas that were part of the 2010 program, and program recommendations. Note that throughout the written text of this report, several terms are presented in a bold font. These terms are defined in Section 5 of this report. For those interested, a detailed description of the WQI's program and methods is maintained on the MLA website.

RiverStone has prepared a two-page summary for each **sampling area** using data collected in 2010 and incorporating some of the historical data collected by the MLA. Long-term trends and noteworthy individual water quality measurements were reviewed for each **sampling area** so that general and specific comments or recommendations could be made. The comments and recommendations provided in the area summaries are intended to increase awareness of the water quality conditions in "your lake neighbourhood." Ideally, these targeted comments will provide the basis for improved and evolving water quality monitoring of specific areas, while continuing to encourage active involvement in monitoring and stewardship activities.

In reviewing the area summaries, it is important to recognize that despite the many proactive steps that you may have taken as good waterfront stewards, your results may not be noticeable on the graphs illustrating the long-term data. Large-scale factors play a key role in controlling aquatic plant and algae growth. For example, global climate change may have increased area lake ice-free periods and water temperatures, influencing water quality to a greater extent than stewardship initiatives. Your local contributions and successes can be measured best by the absence of a negative trend in the numbers (i.e., your ability to keep things constant). While improved water quality is a major goal of the WQI, of

equal importance is the ability of our volunteers to increase awareness of lake health amongst all generations and to encourage engagement in good stewardship practices by all members of our lake communities. We should also recognize that stewardship initiatives undertaken by MLA members on their properties to improve water quality are also beneficial to other aspects of the natural environment.

2. GENERAL METHODS AND WATER QUALITY PARAMETERS

A detailed description of the WQI program and methods can be found in the 2010 Program Delivery and Methodology document, located on the MLA website (www.mla.on.ca). The following points provide a brief overview of the area summary data that has been included in this report.

- **Monitoring schedule** – Water quality indicators including total phosphorus, total coliform, total *Escherichia coli* (***E. coli***) and **Secchi depth** were measured every two weeks, starting in mid-May 2010 for a total of eight sampling periods.
- **Phosphorus (spring turnover)** – Samples collected within or prior to the first sampling period (May 15th to May 24th) are considered spring turnover samples and represent the average phosphorus concentration of a lake. Prior to May 24th, most lakes in our area have not yet stratified (separated into layers); therefore, the concentration of phosphorus in samples taken during this period can be considered the average within the lake.
- **Phosphorus (yearly mean)** – In some areas, samples were collected from deepwater and nearshore sites throughout the sampling season for a total of 8 sampling events. The **yearly mean phosphorus** concentration was calculated for these sites.
- **Secchi depth** – This test is a general indicator of water **clarity** and was measured at deepwater sites.
- **Bacterial sampling** – **Total coliform** and ***E. coli*** samples were collected from nearshore sites as well as some deepwater sites. These bacteria can be indicators of failing septic systems or other forms of fecal contamination.

3. UNDERSTANDING THE AREA SUMMARIES

Based on both the historic data and the data collected in 2010, overall water quality conditions in the lakes monitored by the MLA are good to excellent. A detailed analysis of the long-term data was completed in 2009 and supports this conclusion (see the 2009 Technical Report, available on the MLA website).

The area summaries included in this report are designed to describe the various **sampling areas**, summarize the 2010 data, and explain the general long-term water quality trends associated with each **sampling area** and **sampling site**. The area descriptions were developed based on local knowledge, aerial photos, Ontario Base Maps, and information provided by the DMM by means of surveyed shoreline land-use maps and historical lake data. The names of volunteers involved in the water quality monitoring for each area are listed under "Volunteer Recognition," with team leaders in bold text.

The data in the area summaries are calculated "averages" that provide a general overview of the water quality at individual sampling sites over the sampling season. In some cases, unusually high phosphorus concentrations were excluded from the "average" calculation, as they were not representative of the lake's true nutrient condition and were more likely the result of a contaminated sample. These values were identified as "outliers" when compared to long-term data in the same sampling area. Please note that historical results presented in this report may differ from those presented in previous reports due to differences in data analysis methodology.

The Trends and Comments and/or Recommendations sections are included to enhance your understanding of the water quality conditions in "your lake neighbourhood." In areas where recent data indicate a potential water-quality issue or where the long-term data indicate a low probability for concern, specific recommendations were included.

3.1. Water Clarity

Secchi depth was used to provide a measure of water clarity at deepwater sampling sites. **Secchi-depth values** are determined by averaging the "up" and "down" measurements recorded by volunteers. Secchi data listed in the area summaries represents the **arithmetic mean** of values obtained from individual sampling sites throughout the sampling season. Because water clarity in most lakes in Muskoka is affected by dissolved organic carbon (DOC), which results in tea coloured water, and not just by algal concentrations, the Secchi depths alone can't be considered an indicator of nutrient (phosphorus) status. However, this data is important for monitoring long-term trends.

3.2. Phosphorus

Spring turnover and **yearly mean** total phosphorus data have been provided for all sites monitored in 2010. Current and historical total phosphorus data for the deepwater control site for a sampling area are presented in a graph to show long-term trends. Where appropriate, graphs show MLA data in

relation to the **threshold** concentration set by the DMM or Seguin Township. Starting in 2011, the DMM will be reviewing the Recreational Water Quality Monitoring Program and will remodel some of the lakes as well as some of the basins that are independent from the main part of the lake. One of the possible results of this exercise may be that new **thresholds** will be established and the classification of lakes and basins in terms of their water quality status could change. RiverStone and the MLA's WQI portfolio members have had preliminary discussions with the DMM on how data collected by the MLA could be used to assist in the selection of areas to be remodelled. It is expected that communication between the MLA and the DMM will continue and that the new modelling information will be available in the next couple of years.

On the graphs illustrating long-term phosphorus levels, **threshold** concentrations have been represented by a single black dashed line. For **sampling areas** in the DMM, these values were verified by the DMM. Spring turnover and yearly mean phosphorus as measured by the MLA is shown in µg/L on the y-axis and sampling year is indicated on the x-axis.

3.2.1. Spring Turnover

Spring Turnover phosphorus concentration was calculated as the **arithmetic mean** of the spring or mid-May duplicate sample measurements. **Spring turnover** phosphorus concentrations at the deepwater reference site have been represented graphically as a blue line with diamonds or as single blue diamonds, if consecutive years of data were not available. Note that in previous years, duplicate spring turnover samples were not consistently collected at some sites and for these sites, a single spring turnover sample has been reported.

3.2.2. Yearly Mean

Yearly Mean phosphorus concentration was calculated as the **arithmetic mean** of all measurements from an individual sampling site within the sampling season, including duplicate sample measurements, where available. **Yearly Mean phosphorus** concentrations at the deepwater reference site have been represented graphically as a red line with circles or as single red circles if consecutive years of data were not available.

3.2.3. Nearshore-Deepwater Phosphorus Concentration Comparisons

In **sampling areas** where both nearshore and deepwater phosphorus samples were collected, a statistical test was performed (see Section 3.2.3.1) to compare the data collected at each nearshore site to the data collected at the deepwater reference site. Nearshore sites identified to be significantly different from their deepwater reference site have been identified in the area summaries under the Comments and Recommendations section.

Of the 22 sampling areas where both nearshore and deepwater data were collected, only nine areas had nearshore phosphorus concentrations that were significantly greater than the deepwater site. For eight of these nine areas, only one of the nearshore sites sampled was significantly higher than the deepwater site and each of these were either in a river/creek or were located at a river/creek outlet. The ninth **sampling area** had two nearshore sites that were elevated when compared to the deepwater site. These sites were again, both associated with a creek or river. Specific recommendations and comments are provided for these areas (Boyd Bay-BOY, Hamer Bay-HMB, Muskoka Bay-MBA, Morgan Bay-MGN, Muskoka River-MRV, Muskoka Sands-MSN, Rosseau North-RSH, Skeleton Bay-SKB and Windermere-WIN) on the summary pages under the Comments and/or Recommendations section.

3.2.3.1 Statistical Details

A one-way Analysis of Variance (ANOVA) was completed on the log-transformed phosphorus data for each area. Transforming data is a technique used by statisticians to "normalize" data that is skewed in one direction (e.g., when there are many more smaller values than larger values). Transforming data ensures valid statistical analysis when it may not be possible otherwise. If an overall significant difference ($P < 0.05$) was detected between the mean phosphorus values of all sampling sites in an area, a Multiple Comparison Test (the Holm-Sidak method) was conducted to determine which sites differed significantly from the deepwater reference site. In a small number of cases, log transformation did not normalize the data, and an Analysis of Variance on Ranks (Kruskal-Wallis test) was performed, with Dunn's Method as a multiple comparison test.

3.3. Bacteria

Total coliforms and total ***E. coli*** data have been summarized for all sites monitored in 2010. Current and historical ***E. coli*** data have also been presented graphically. ***E. coli*** concentrations are reported as the number of colony forming units observed in 100 mL of lake water (cfu/100 mL) on the y-axis and

sampling sites are indicated on the x-axis. For the *E. coli* graphs, each sampling site is represented as a cluster of bars and different sampling seasons (years) are represented by different coloured bars. Each graph also compares ***E. coli*** levels to the MLA upper limit, which is represented by a grey dotted line. The upper limit value (10 cfu/100 mL) was established as a reasonable limit for maintaining existing water quality in Muskoka for the WQI and is based on advice provided by Dr. Karl Scheifer (2003). It is important to note that a "potential health hazard exists if the fecal coliform geometric mean density for a series of water samples exceeds 100 CFU/100 ml" (Ontario Ministry of the Environment).

3.3.1. Total Coliforms

Total coliform data is summarized for areas where bacterial monitoring was conducted in 2010. **Total coliform** levels are presented as yearly averages calculated as the **geometric mean** of all measurements for an individual sampling site.

3.3.2. *E. coli*

E. coli data is summarized for areas where bacterial monitoring was conducted in 2010. ***E. coli*** levels are presented as yearly averages calculated as the **geometric mean** of all measurements for an individual sampling site. Current and historical ***E. coli*** levels are also illustrated graphically in area summaries. It is important to note that in creating the *E. coli* graphs, every site that was sampled had a minimum value of 1 cfu/100 mL; where no bar is shown for a particular site/year, no data was collected.

The MLA WQI established a field protocol during 2010 that required volunteers to resample a site weekly if ***E. coli*** were greater than 50 cfu/100 mL over two consecutive sampling periods. This was a cautious approach that allowed the MLA to monitor sites that demonstrated potential for ongoing concern. Following this protocol, ***E. coli*** levels exceeded 50 cfu/100 mL at three of the 139 bacteria sampling sites in 2010. In addition, 12 sites had ***E. coli*** levels exceeding 100 cfu/100 mL on a single occasion. Two sites (MBA-12 and MSN-4, both of which are located within a creek or river) had persistently high *E. coli* levels, resulting in site-specific recommendations being provided on the summary sheets.

3.4. Maps

Updated 2008 aerial photos were extracted from the Muskoka Web Map website and the West Parry Sound Geography Network website and were labelled to show sampling locations for the 2010 season. Site information was compiled using the MLA Water Quality Results map, with information for the new or altered sites provided by MLA staff or directly from volunteers. Yellow dots indicate nearshore sampling sites, while red stars represent deepwater sampling sites.

3.5. Review of DMM benthic monitoring data

Many of the sampling areas have volunteers that have participated in the Benthic Macroinvertebrate Monitoring Program offered through the DMM. The DMM offers this program through the Ontario Benthic Biomonitoring Network (**OBBN**). RiverStone reviewed the data collected from 2010 and historically.

Benthic (bottom dwelling) aquatic invertebrates can be a biological indicator of water quality. The combination of nearshore phosphorus data and benthic data collected in the same year can provide a better understanding of water quality than when each type of data is considered separately. Where benthic data was available for a given area, this information was reviewed to determine if the MLA's chemical data and the OBBN data provided through the DMM suggest different levels of water quality. A total of six areas had benthic data and comments for these areas have been provided on the summary sheets. In a number of areas, water chemistry data and benthic data both suggest that water quality is below the average Muskoka condition. The most notable of these is in the Hoc Roc River (MSN-4), where the MLA water chemistry and bacteria data indicate that this is an area of concern and the water quality index associated with benthic data is well below the Muskoka average.

4. CONCLUSIONS AND PROGRAM RECOMMENDATIONS FOR 2011

4.1. Conclusions

The success of the 2010 WQI can be described in a number of ways. The program successfully completed a number tasks that are summarized below.

1. A volunteer-based lake monitoring program was completed over a large number of lakes and sampling areas.
2. The data collected contributed to a well-established long-term monitoring program started by the MLA.

3. A new and more streamlined reporting structure was developed that could communicate the programs results to the MLA members, government, and the general public.
4. Open and frank discussions with the DMM were held, which in turn has created a potential opportunity for the MLA to use its long-term spring-turnover data to assist with the selection of areas to be considered for remodeling in 2011.

The data collected by the WQI in 2010 can be used to draw a number of conclusions in terms of water quality in the lakes in Muskoka as well as about the program itself. The following conclusions are noted.

5. The trend for spring turnover phosphorus at the deepwater reference sites has been generally downward over the past several years.
6. The *E. coli* values recorded for the vast majority of the sites sampled are well within the expected range of values that would occur naturally, with most being below the MLA's desired upper limit of 10 cfu/100 ml. Those sites that were chronically elevated have been identified and would benefit from the development of more detailed studies.
7. The statistical analysis of nearshore versus deepwater phosphorus data confirmed that, of the sites sampled in 2010, only sites adjacent to or within creeks/rivers were significantly different from the deepwater reference site. More detailed studies can be developed in the future for the sites within creeks/rivers identified as possible sources of phosphorus. Other nearshore sites that were not significantly different from their deepwater controls could either be removed from the program to allow expansion to other sites or they could remain in the program as long-term monitoring sites.

4.2. Recommendations

Based on observation of the program through the 2009 and 2010 sampling seasons and a complete data review, RiverStone would provide the following recommendations for the various components of the WQI program:

1) Training

The final cost associated with each sample collected by a volunteer as part of the WQI program has been estimated to be $40. Both the monetary value and the importance of each data point collected means that everything possible should be done to ensure each sample counts. Proper training of all volunteers is a major part of this.

- *All team leaders need to attend the training sessions and encourage as many team members as possible to attend.*

2) Methods

- *Stress to team leaders that E. coli wells can only be counted as positive if they were green/blue when counting total coliforms **and** fluorescent when counting for E. coli.*
- *Consult with Dr. Karl Schiefer regarding the interpretation of the ColiPlate results, particularly with respect to what should be counted as a positive well for total coliforms.*
- *Filter all phosphorus samples using an 80 micron filter.*
- *Continue to have a Field Coordinator to support the volunteers and manage data.*
- *Continue to have the Field Coordinator review data forms and data after every sampling date, including the E. coli results, and follow up quickly to obtain missing information.*

3) Education

- *Continue to work with and create additional Stewardship Initiative Groups where potential water quality issues have been identified. Some new areas to consider include Windermere, Muskoka Sands, and Indian River.*
- *Continue to monitor the development practices of each municipality and provide input when possible for district official plan updates, and local official plans and zoning by-laws. Work with each new government/councillors such that a better understanding of water quality issues is developed early in new member's term. Sound planning decisions and enforcement are **key** factors in maintaining and improving water quality.*
- *Continue to review available public education programs and provide information for such programs on the MLA website. This will assist in promoting Good Stewardship Practices and awareness of Muskoka's Natural Environment with the membership and others.*

4) Program

- *Based on the recommendations provided for each specific area, team leaders and the field co-ordinator should review the E. coli sampling sites. Sites that have measured below the MLA's upper limit for the past three years should be replaced with new sampling sites to allow for increased monitoring, unless a specific site is located in a public swimming area.*
- *Continue to monitor all deepwater reference sites for spring turnover and yearly mean phosphorus concentrations.*
- *Consider the development of a different research component to identify sources of phosphorus. One suggestion would be the measurement of deepwater phosphorus and possibly dissolved oxygen during late summer (when the lakes are stratified) to determine if elevated phosphorus concentrations occur in deepwater zones. Elevated phosphorus in deepwater, when compared to surface water, can indicate an area that has become anoxic, resulting in the release of phosphorus from the sediments.*
- *Select some nearshore reference sites to monitor as part of a long-term phosphorus monitoring program. Consider discontinuing the other sites and select new sites to test based on volunteer input and on the value each of each new site to the objectives of the program.*

5. DEFINITIONS

Arithmetic mean: This type of average is calculated by adding together a group of numbers and dividing the sum by the number of numbers.

Clarity: Water clarity is a measure of how much light penetrates through the water column. The clarity of water is influenced both by suspend particulate matter (sediment, and plankton) and by coloured organic matter (tea coloured lakes). Clarity can provide some indication of a lake's overall water quality, especially the amount of algae present.

Geometric mean: This type of average is calculated by multiplying together a group of *n* numbers and then taking the n^{th} root of the resulting product. Geometric mean is used to indicate the central tendency or typical value of a set of numbers. It is typically used to calculate average bacteria counts because as a living organism, bacteria counts are highly sporadic and inconsistent.

Lake System Health Monitoring Program: A field-based program designed and operated by the DMM that monitors approximately 192 sample locations across Muskoka on a rotating basis depending upon development pressures and the specific characteristics of the lake. The purpose of the program is to establish a long-term record of key water quality parameters so that trends in water quality can be identified. Spring turnover total phosphorus results of this program inform Muskoka's Recreational Water Quality Model.

Mesotrophic: A mesotrophic lake typically has phosphorus concentrations between 10 and 20 µg/L (Level 2–mid-range, MOE). Mesotrophic lakes are lakes with an intermediate level of productivity, greater than oligotrophic lakes, but less than eutrophic lakes. These lakes are commonly clear water lakes and ponds with beds of submerged aquatic plants and medium levels of nutrients.

Oligotrophic: An oligotrophic lake typically has phosphorus concentrations less than 10 µg/L (Level 1–nutrient-poor, MOE). These lakes have low primary productivity, due to the low nutrient content. These lakes have low algal production, and consequently, often have very clear waters, with high drinking-water quality. The bottom waters of such lakes typically have ample oxygen; thus, such lakes often support many fish species, like lake trout, which require cold, well-oxygenated waters.

OBBN: (Ontario Benthic Biomonitoring Network) The Ministry of the Environment and Environment Canada have developed an aquatic macroinvertebrate biomonitoring network for Ontario's lakes, streams, and wetlands. The program is built on the principles of partnership, free data sharing, and standardization. The OBBN is biological monitoring program (not chemistry) that uses a reference-condition approach to define criteria: samples from minimally impacted sites define an expectation (the normal range) for biological condition at a test site. Assessments evaluate whether a test site's biological condition is within the normal range. New partnerships, and the ability to generate local information on aquatic condition, will build capacity for adaptive water management and enhance the link between science and decision-making (Jones et al, 2006).

Threshold: The "Threshold" phosphorus concentration is 50% more than the baseline (Background) concentration calculated by the District of Muskoka or Seguin Township. The threshold is used to

classify lakes and bays as requiring a higher level of development control as a precautionary action to protect the long-term health of the lake.

Total Coliform: Coliform include a variety of bacteria. In practice, detectable coliform are usually enteric, found in the intestinal tracts of humans and other warm-blooded species.

***E. coli*:** Fully known as *Escherichia coli*, it is a subset of total coliforms, and is exclusively associated with fecal waste (Schiefer, 2001) making it a good indicator of faecal contamination. There are many different strains of *E. coli*; most waterborne strains are themselves not harmful, but some (such as *E. coli* O157:H7) can cause serious illness (OMH, 2001).

Total Phosphorus: Phosphorus is a chemical element that is essential for all living cells. Amongst other sources, it is found in fertilizers, soaps, and in human waste. Typically phosphorus is not removed from waste streams by conventional private treatment systems (septic systems) nor by some municipal treatment systems.

Muskoka Recreational Water Quality Model: An advanced numerical model operated by the District of Muskoka designed to predict the response of all individual lakes in Muskoka to the input of phosphorus. The model is based on the Ontario Lakeshore Capacity Simulation Model, originally published in 1986 by a Provincial inter-ministerial working group. This model was substantially updated in 2005 by Dr. Neil Hutchinson of Gartner Lee Ltd. for the District of Muskoka (GLL, 2005). The model includes a detailed phosphorus budget. Its inputs are the results of the District's Lake System Health Monitoring Program. Among the model's outputs is lake-specific Natural Phosphorus, Phosphorus Threshold and predicted phosphorus concentrations.

Sampling Area: A geographic location encompassing a group of WQI monitoring sites.

Secchi Depth: A measure of water **clarity**, measured using a Secchi disk - a small disk attached to a rope. Alternating quarters of the top side of the disk are coloured white and black. The Secchi depth is the depth of water whereby the sampler can no longer distinguish the white and black quarters of the disk.

Sampling Site: The discrete and unique location where samples are to be collected on each sample date.

Spring Turnover Phosphorus: A single phosphorus concentration measurement taken in a typically stratified lake during the spring turnover period. This measurement has been shown to adequately represent the overall phosphorus concentration in a lake (Clark, 1992). Typically the spring turnover lasts for a few days when the temperature of the entire water column is consistent (usually 4˚C) allowing the water column to mix. In practice, measurements taken anytime in May are considered to be adequate by Ontario's Ministry of the Environment (http://www.ene.gov.on.ca/envision/water/lake_partner/index.htm).

Yearly Mean Phosphorus: The arithmetic mean of phosphorus concentration measurements taken above a stratified water column's thermocline over the ice-free period. ***Note:*** **yearly mean phosphorus concentration as reported by the WQI is for summer months only.**

Note: many of these definitions have been taken from the WQI Monitoring Program Summary Report - Citizens Environment Watch 2009.

6. REFERENCES

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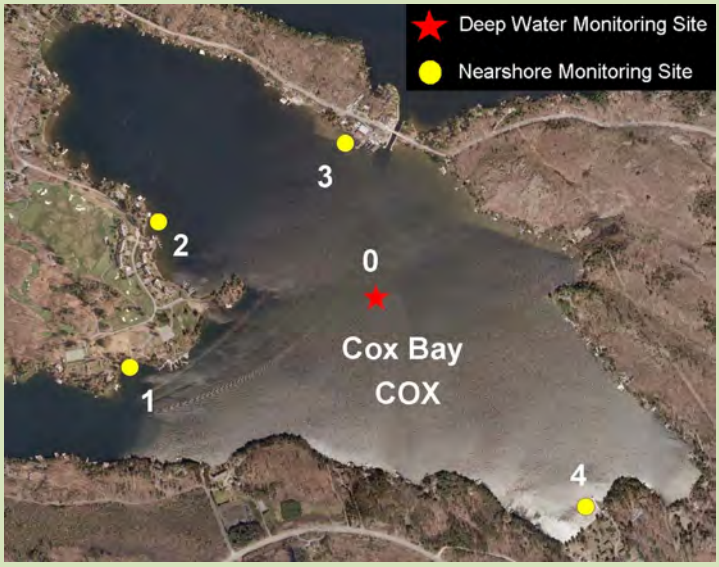
AREA SUMMARIES

COX BAY (COX)



Area Description

Cox Bay is the southernmost bay of Lake Joseph. The bay is 1.84 km² in area and is up to 12 m in depth. A large resort and golf course are located adjacent to the lake, along with a marina and a canal crossing into Lake Rosseau at Port Sandfield. Most of the shoreline area is developed, but many residences maintain a forested cover on their properties. More than 15% of the shoreline is open lawn, pavement or is intensely landscaped. The Cox Bay Stewardship Initiative group has identified ten permanent watercourses that drain into the bay. Cox Bay is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Cox Bay was monitored in 2010 by **Gord Ross**.

2010 Data

COX-0: TP-Spring turnover = 4.4 µg/L
TP-Yearly mean = 4.0 µg/L
Secchi = 4.7 m

COX-1: TP-Yearly mean = 4.5 µg/L
Total coliforms = 62 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

COX-2: TP-Yearly mean = 4.6 µg/L
Total coliforms = 70 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

COX-3: TP-Yearly mean = 6.2 µg/L
Total coliforms = 121 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

COX-4: TP-Yearly mean = 4.4 µg/L
Total coliforms = 30 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of Cox Bay started in 2002. Total phophorus values fluctuated from 2002-2008, but have remained steady near the threshold value over the past two years. 2010 *E. coli* levels were within their historic ranges, remaining below the MLA upper limit.

*2008 spring turnover phosphorus duplicate outlier removed (8.4/20.8)

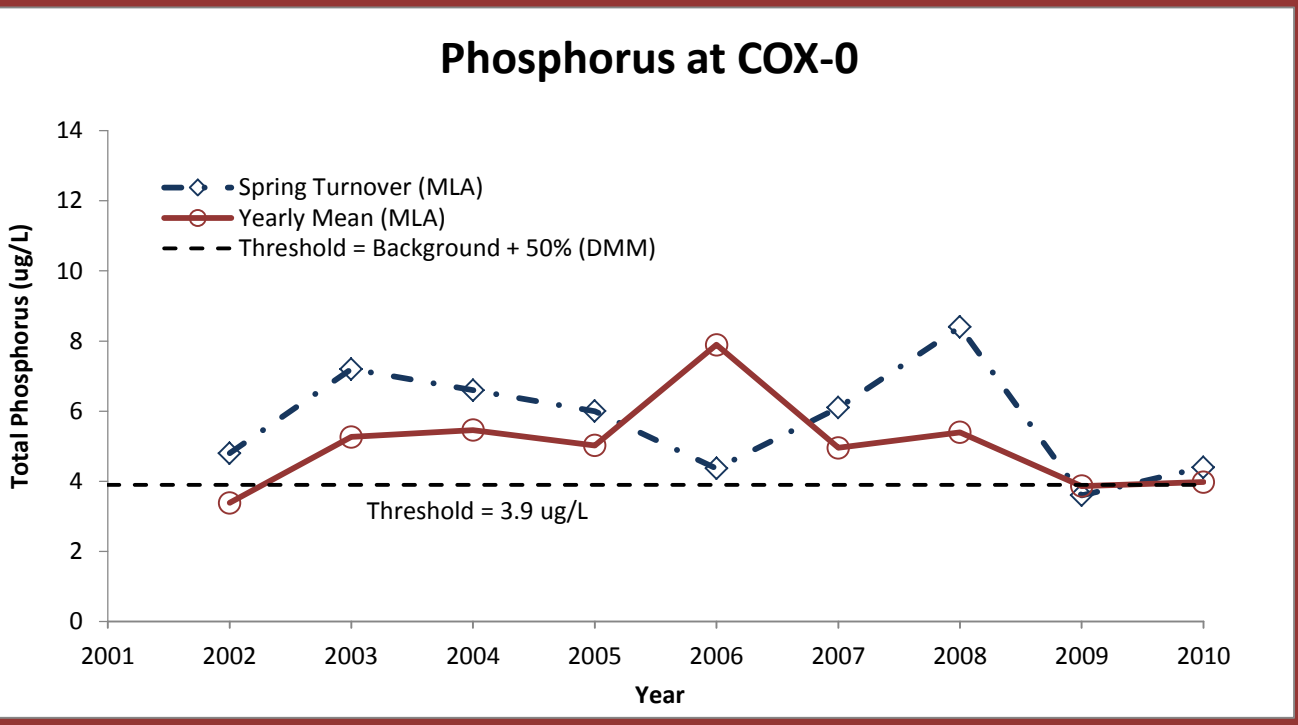
Comments and/or Recommendations

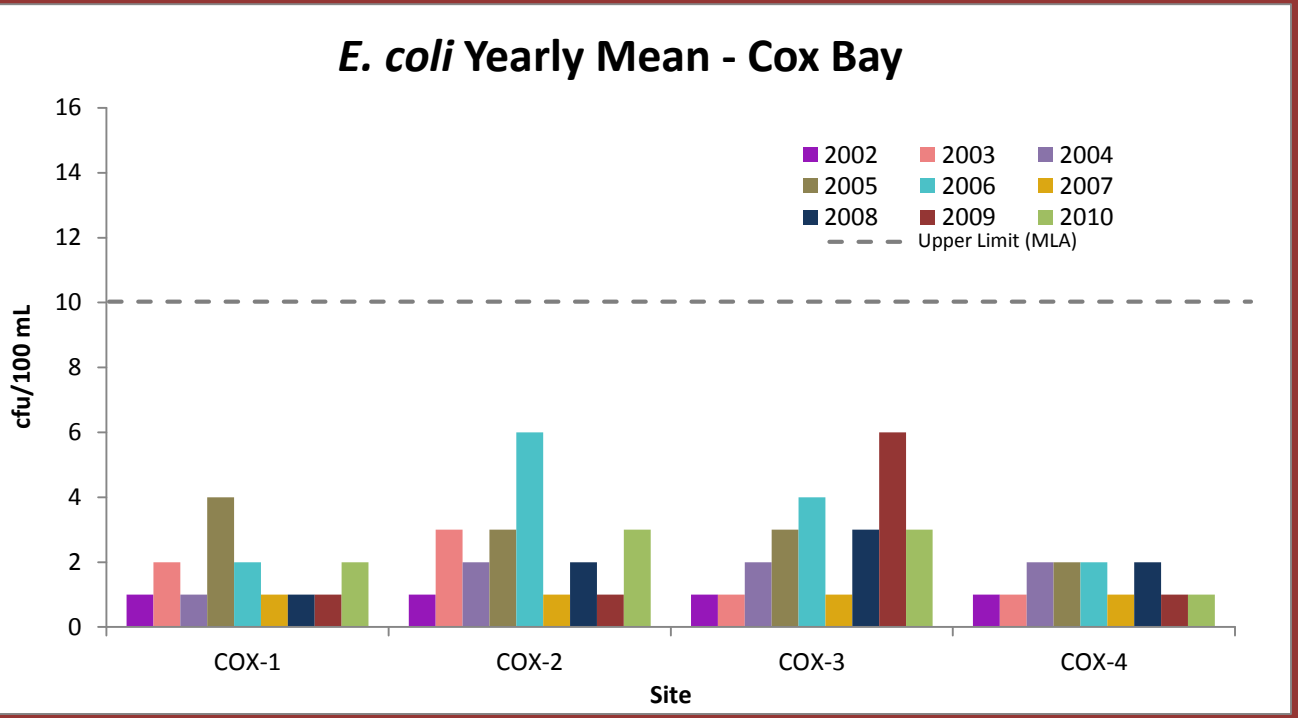
Nearshore sampling did not detect land-based influences on nearshore phosphorus.

Continue to work with the MLA Stewardship Initiative Program to refine detailed monitoring plans and remedial actions within Cox Bay.

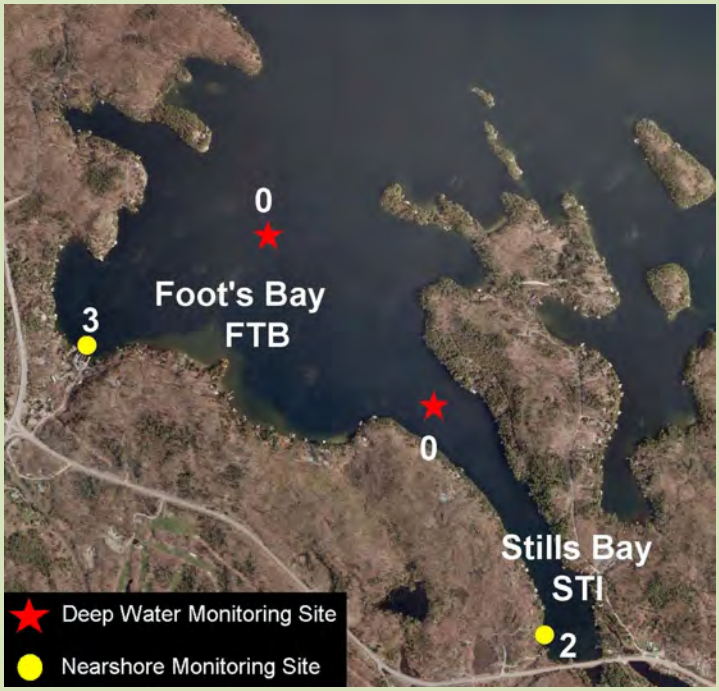
9 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at COX-1, 2, 3, and 4 and establishing new sampling sites.

(COX) COX BAY


Phosphorus at COX-0
Total Phosphorus (ug/L)
14
12
10
8
6
4
2
0
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
Threshold = 3.9 ug/L
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year


E. coli Yearly Mean - Cox Bay
cfu/100 mL
16
14
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
Upper Limit (MLA)
COX-1
COX-2
COX-3
COX-4
Site

FOOT'S BAY & STILLS BAY (FTB/STI)



Area Description

Foot's Bay and Stills Bay are connecting bays in the south-eastern portion of Lake Joseph. Stills Bay is long, narrow, and moderately developed. The southern end of the bay is directly adjacent to highway 169. This bay receives drainage from watercourses that are adjacent to a golf course. Foot's Bay has a higher intensity of development in the southern section, with areas that are adjacent to the highway and a marina. There are still large areas of shoreline with mostly intact forests. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Foot's Bay and Stills Bay were monitored in 2010 by **Joey Brown**, Jane Craig, **Neil Shaw**, and Pixie Shaw.

2010 Data

FTB-0: TP-Spring turnover = 2.3 µg/L*
TP-Yearly mean = 3.0 µg/L
Secchi = 5.5 m

FTB-3: TP-Yearly mean = 3.4 µg/L

STI-0: TP-Spring turnover = 2.8 µg/L*
TP-Yearly mean = 4.7 µg/L
Secchi = 5.0 m

STI-2: TP-Yearly mean = 8.0 µg/L

* Single spring turnover sample; duplicate sample not collected.

Trends

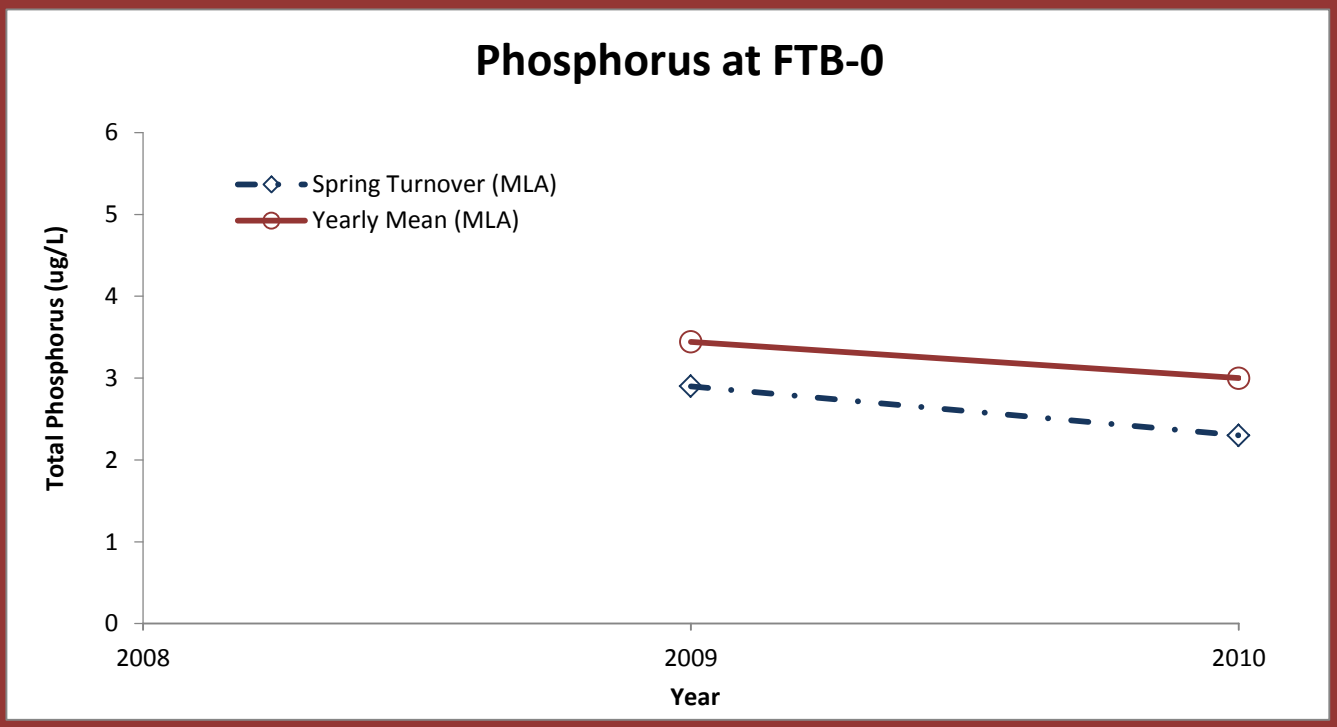
Monitoring of Foot's Bay started in 2009. Both spring turnover and yearly mean phosphorus concentrations were lower in 2010 than in 2009.

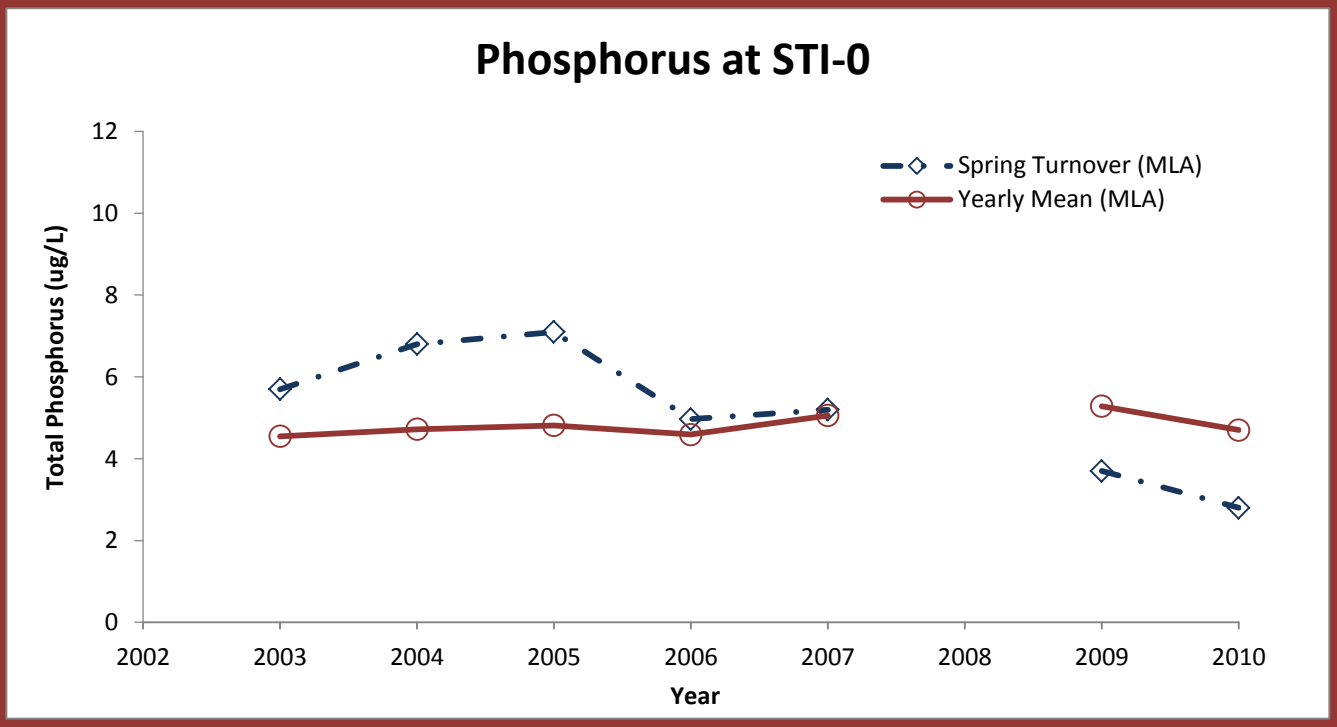
Monitoring of Stills Bay started in 2003. Spring turnover concentrations have been trending downward since 2005 Yearly mean phosphorus has remained fairly stable from 2003-2010.

Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

(FTB/STI) FOOT'S BAY & STILLS BAY





GORDON BAY (GNB)

Area Description

Gordon Bay is in the north-western part of Lake Joseph. This bay is moderately developed and highway 169 follows along the shoreline for a large portion of the bay. There is a large marina in the northern part of the bay where one of three creeks discharges into the bay. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Gordon Bay was monitored in 2010 by Andrew Watson.

2010 Data

GNB-0: TP-Spring turnover = 4.5 µg/L
Secchi = 5.3 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

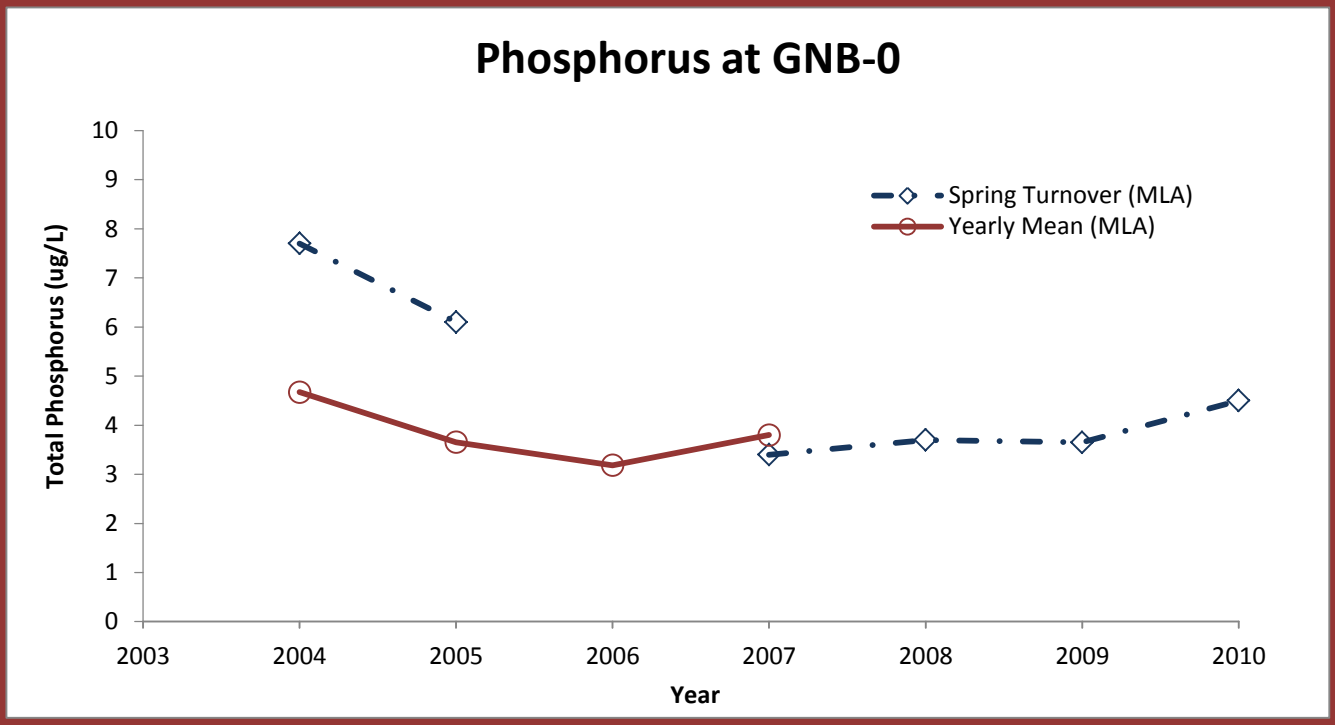
Spring turnover phosphorus concentrations have trended slightly upward from 2007-2010, but are lower than those observed in 2004 and 2005.

Total coliforms and *E. coli* were not sampled in this sampling area.

Comments and/or Recommendations

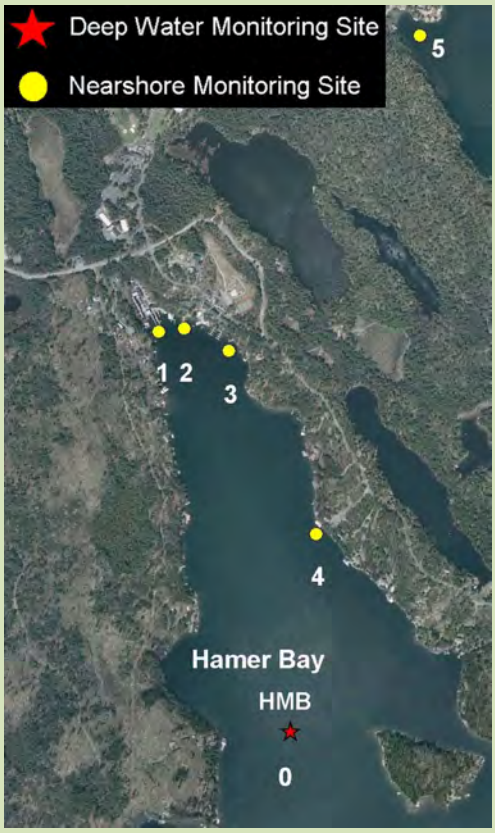
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(GNB) GORDON BAY



Notes:

HAMER BAY (HMB)



Area Description

Hamer Bay is a large bay in the northern part of Lake Joseph. This bay receives drainage from a variety of natural and anthropogenic sources. There are three creeks that outlet into the bay, one flows through a large golf course and wetland in the north, and the others through smaller lakes and wetlands. There is a large marina with several parking lots, a resort, and many residential properties along most of the available shoreline. The main basin of Lake Joseph is classified as highly sensitive by the DMM.

Volunteer Recognition

Hamer Bay was monitored in 2010 by **Brian Smith** and Jim McLellan.

2010 Data

HMB-0: TP-Spring turnover = 5.3 µg/L
TP-Yearly mean = 3.8 µg/L
Secchi = 5.4 m
Total coliforms = 6 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

HMB-1: TP-Yearly mean = 7.0 µg/L
Total coliforms = 23 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

HMB-2: TP-Yearly mean = 4.0 µg/L
Total coliforms = 13 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

HMB-3: TP-Yearly mean = 3.8 µg/L
Total coliforms = 16 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

HMB-4: TP-Yearly mean = 3.9 µg/L
Total coliforms = 10 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

HMB-5: TP-Yearly mean = 4.2 µg/L

Trends

Monitoring of Hamer Bay started in 2002. Since 2003, both spring turnover and yearly mean phosphorus concentrations have fluctuated above the threshold value.

In 2010, *E. coli* levels at HMB-1 remained elevated, but all observed values were below the MLA upper limt.

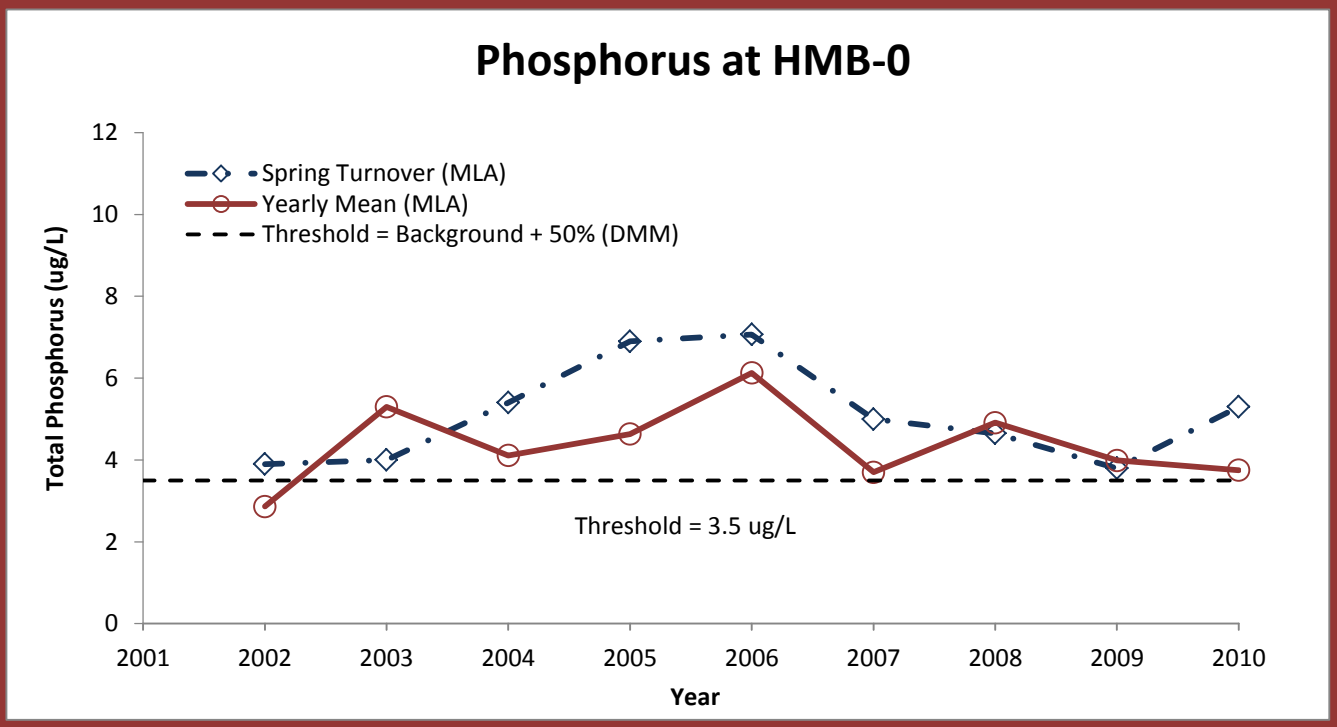
Comments and/or Recommendations

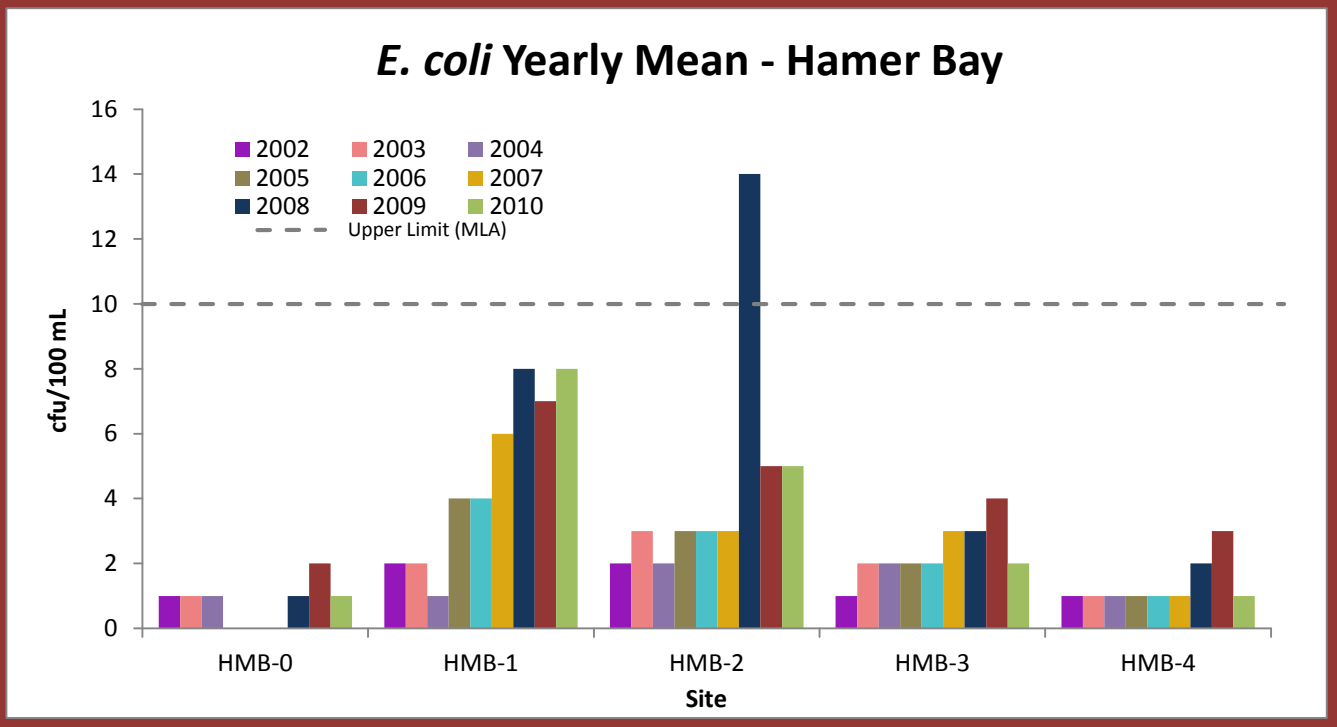
Nearshore sampling at HMB-1 suggests potential land-based influences on nearshore phosphorus.

In 2011, continue to monitor bacteria and phosphorus at HMB-1. Land use and site conditions should also be documented at this site.

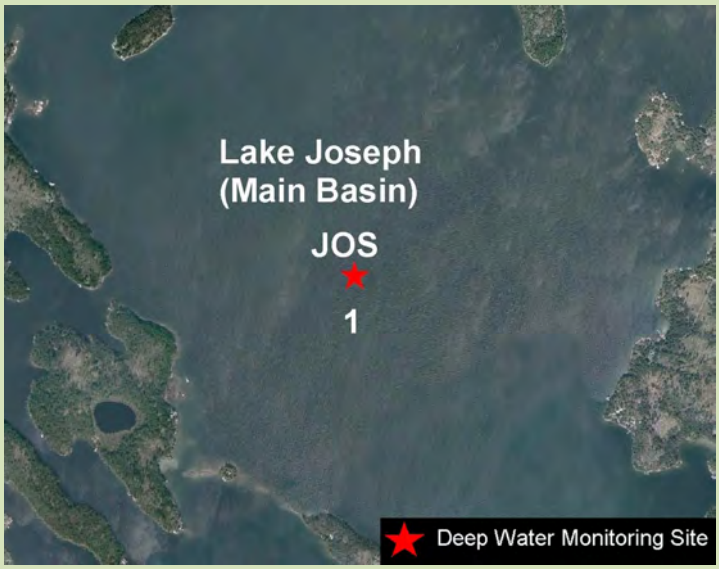
9 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at HMB-3 and HMB-4 and establishing new sampling sites.

(HMB) HAMER BAY





LAKE JOSEPH (JOS-1)



Area Description

Lake Joseph is a large lake with a surface area of 50.9 km² and water depths of up to 60 m. Wetlands account for a small portion of the lake area at approximately 5%. The lake has various points of inflow and outflow, with drainage from north to south. The Lake Joseph watershed area is 55 km² and has a coldwater fishery. The DMM has classified the main basin of the lake as highly sensitive.

Volunteer Recognition

Lake Joseph was monitored in 2010 by Charlie Dalton, Judi Dalton, Peter Dalton, Sarah Dalton, and **Brian Smith**.

2010 Data

JOS-1: TP-Spring turnover = 6.9 µg/L
TP-Yearly mean = 3.6 µg/L
Secchi = 6.3 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

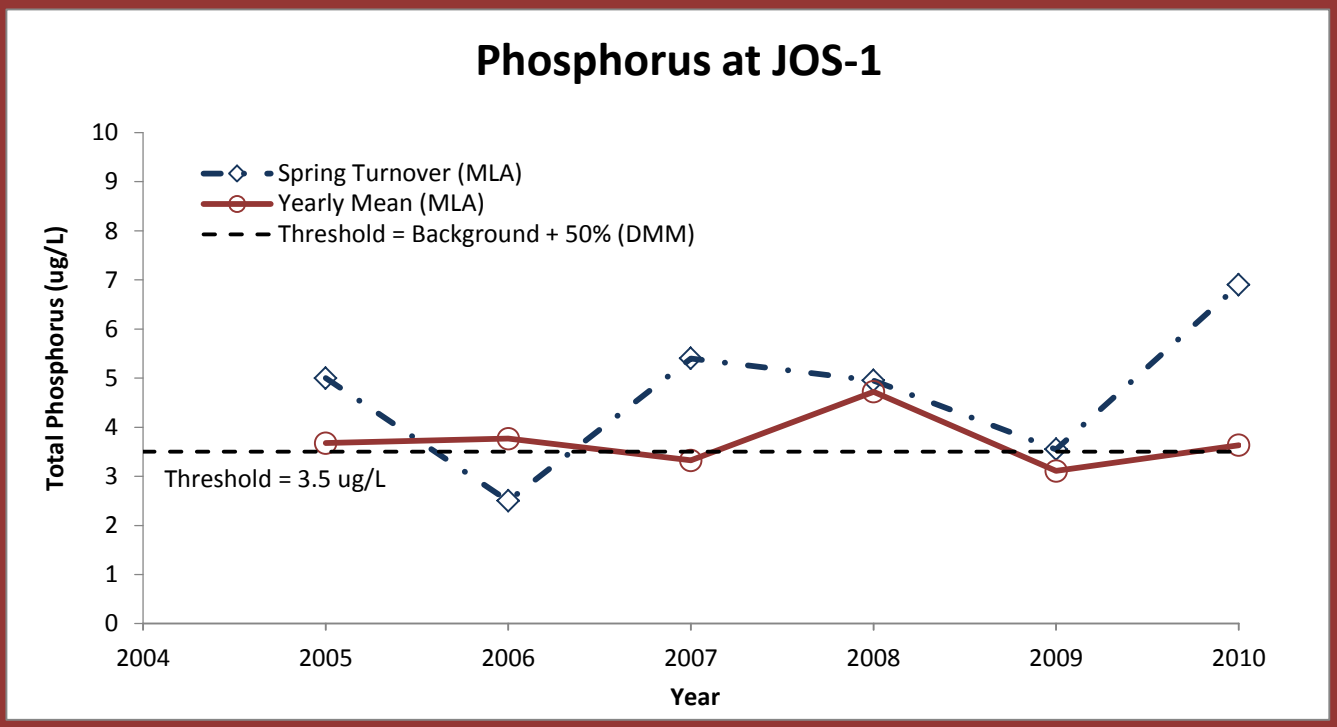
Monitoring of Lake Joseph's main basin started in 2005. Since then, spring turnover phosphorus concentrations have fluctuated and, other than in 2008, yearly mean concentrations have remained at or near the threshold level.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

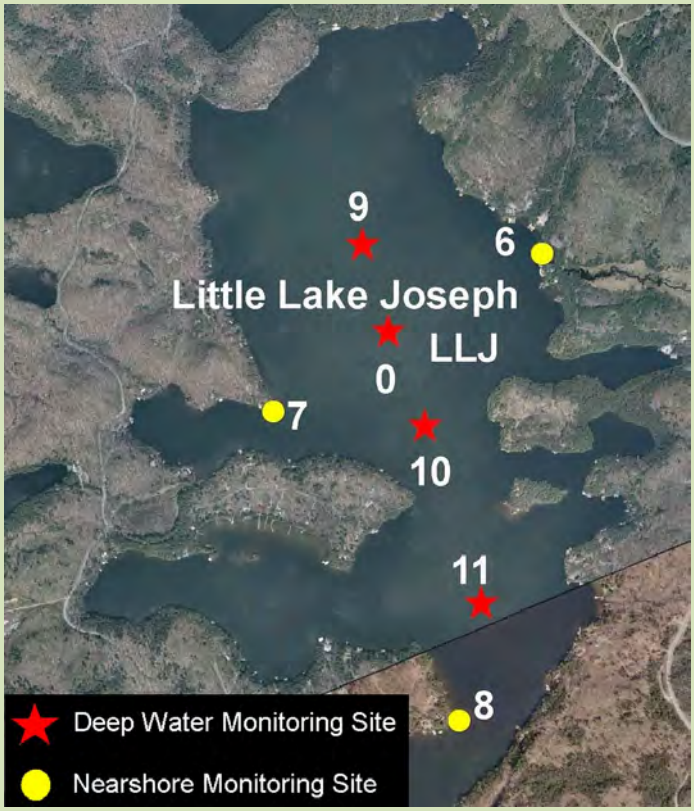
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(JOS-1) LAKE JOSEPH



Notes:

LITTLE LAKE JOSEPH (LLJ)



Area Description

Little Lake Joseph is an isolated arm 2.8 km² in size off the eastern side of Lake Joseph. This is a deep bay with depths of up to 40 m. Most of the shoreline is in a natural state despite many cottages. Three small wetlands outlet into the bay and the DMM has classified Little Lake Joe as moderately sensitive.

Volunteer Recognition

Little Lake Joseph was monitored in 2010 by Denis Jean-Marie, **Dirk Soutendijk**, and Mary Soutendijk.

2010 Data

LLJ-0: TP-Spring turnover = 6.5 µg/L
TP-Yearly mean = 7.1 µg/L
Secchi = 4.6 m

LLJ-9: Total coliforms = 4 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

LLJ-10: Total coliforms = 16 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

LLJ-11: Total coliforms = 21 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of Little Lake Joseph started in 2005. Spring turnover and yearly mean phosphorus concentrations were steady over the period of 2009-2010.

In 2010, *E. coli* was found in low concentrations at each of the deepwater sites monitored.

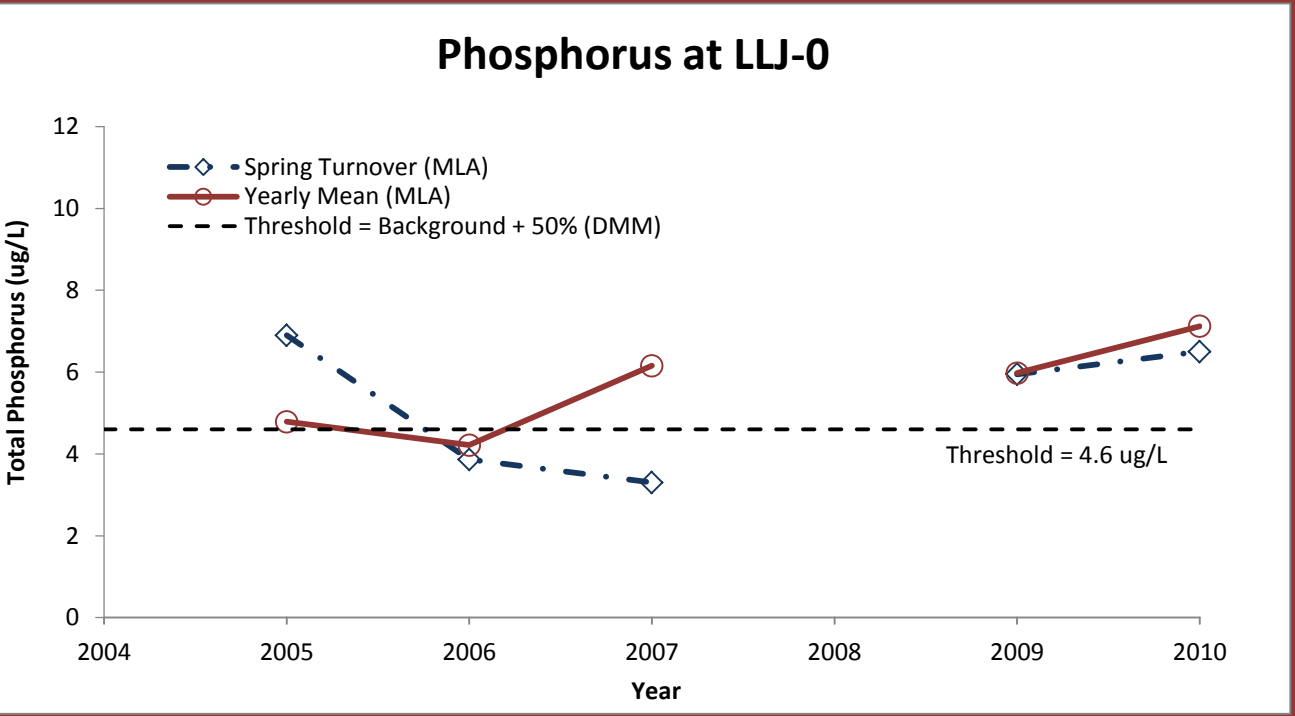
Comments and/or Recommendations

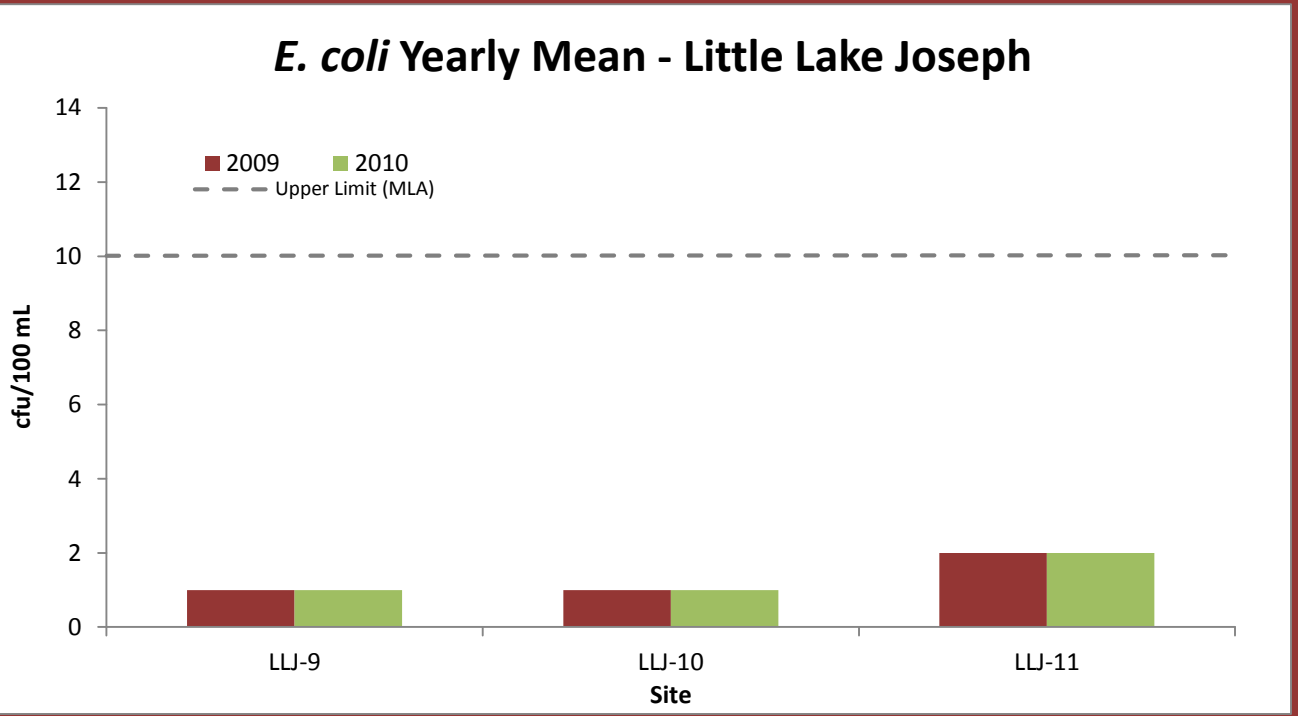
All three bacteria monitoring sites were in deep water and results were within the expected range.

Limit *E. coli* sampling to one deepwater location and nearshore sites adjacent to heavy land use.

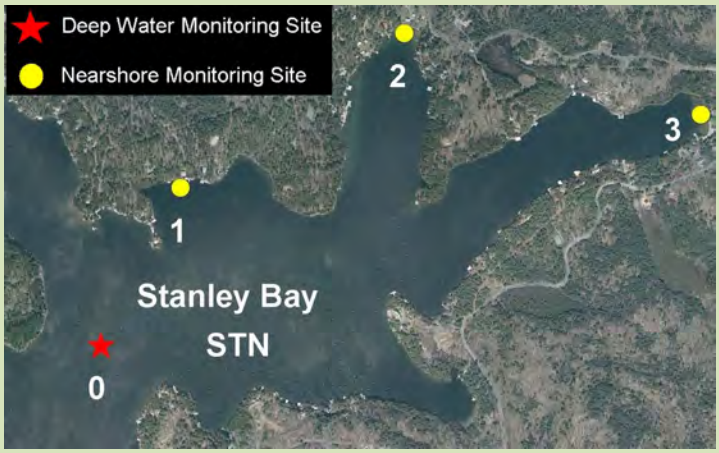
Continue sampling LLJ-0 for spring turnover phosphorus to monitor long-term trends.

(LLJ) LITTLE LAKE JOSEPH





STANLEY BAY (STN)



Area Description

Stanley Bay is located on the north-east side of Lake Joseph. This deep water bay has evenly distributed development with largely intact forest cover along the shoreline. STN-2 and STN-3 are located in shallow, sandy areas at the base of small bays where creeks outlet. There are several roads around this bay and a moderate level of residential development, but no marinas, large resorts, commercial or agricultural development which could negatively impact water quality.

Volunteer Recognition

Stanley Bay was monitored in 2010 by Charlie Dalton, Judi Dalton, Peter Dalton, Sarah Dalton, and **Brian Smith**.

2010 Data

STN-0: TP-Spring turnover = 4.1 µg/L
TP-Yearly mean = 3.0 µg/L
Secchi = 6.1 m

STN-1: TP-Yearly mean = 3.2 µg/L

STN-2: TP-Yearly mean = 3.0 µg/L

STN-3: TP-Yearly mean = 4.2 µg/L

Trends

Monitoring of Stanley Bay started in 2004. Since then, yearly mean phosphorus concentrations have have been relatively stable.

Spring turnover phosphorus concentrations were elevated in 2004 and 2005, but have remained stable since 2007.

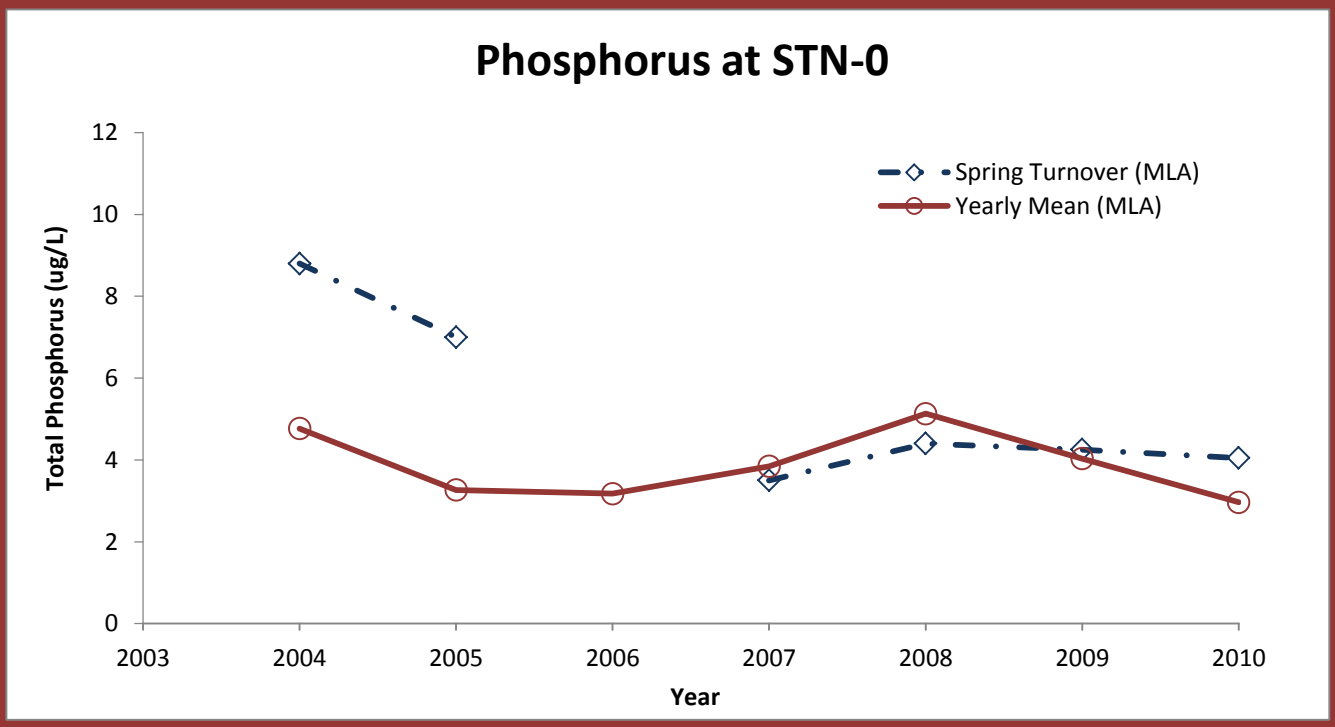
Total coliform and *E. coli* were not monitored in this sampling area.

Comments OR Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

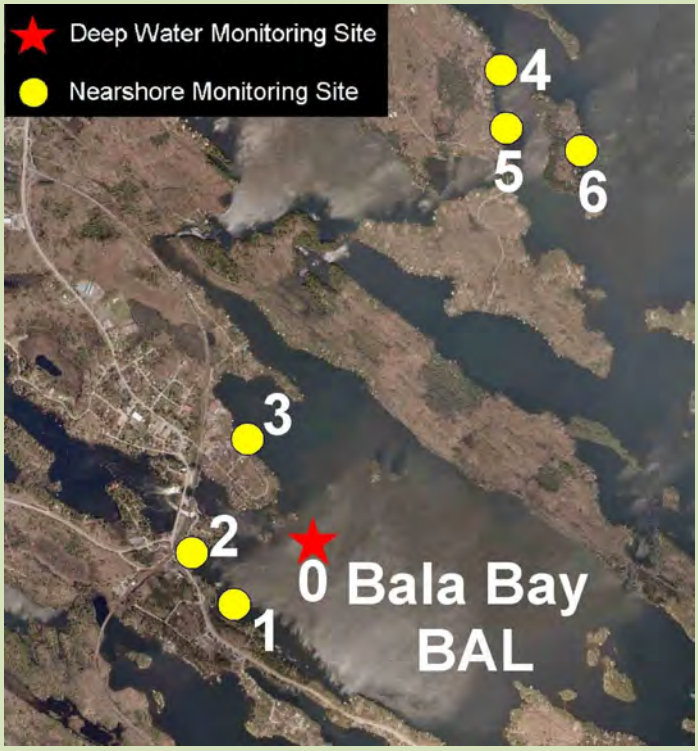
Nearshore phosphorus concentrations are very low; consider changing site locations in 2011.

(STN) STANLEY BAY



Notes:

BALA BAY (BAL)



Area Description

Bala Bay is a large isolated bay in the eastern part of Lake Muskoka. Most of the bay is densely developed but there is intact forest cover along most of the shoreline area. Drainage from the village of Bala does enter the bay along the western shore. The entire Muskoka River Watershed drains through Bala Bay into the Moon River System. There are also two small wetlands that drain into the bay.

Volunteer Recognition

Bala Bay was monitored in 2010 by Alan Hutton, Joan Joel, **Peter Joel**, Eleanor Lewis, Jim Lewis and Dalton Lordly.

2010 Data

BAL-0: TP-Spring turnover = 3.6 µg/L
Secchi = 4.2 m
Total coliforms = 18 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

BAL-1: Total coliforms = 158 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

BAL-2: Total coliforms = 287 cfu/100 mL
Total *E. coli* = 12 cfu/100 mL

BAL-3: Total coliforms = 77 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BAL-4: Total coliforms = 121 cfu/100 mL
Total *E. coli* = 10 cfu/100 mL

BAL-5: Total coliforms = 74 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

Trends

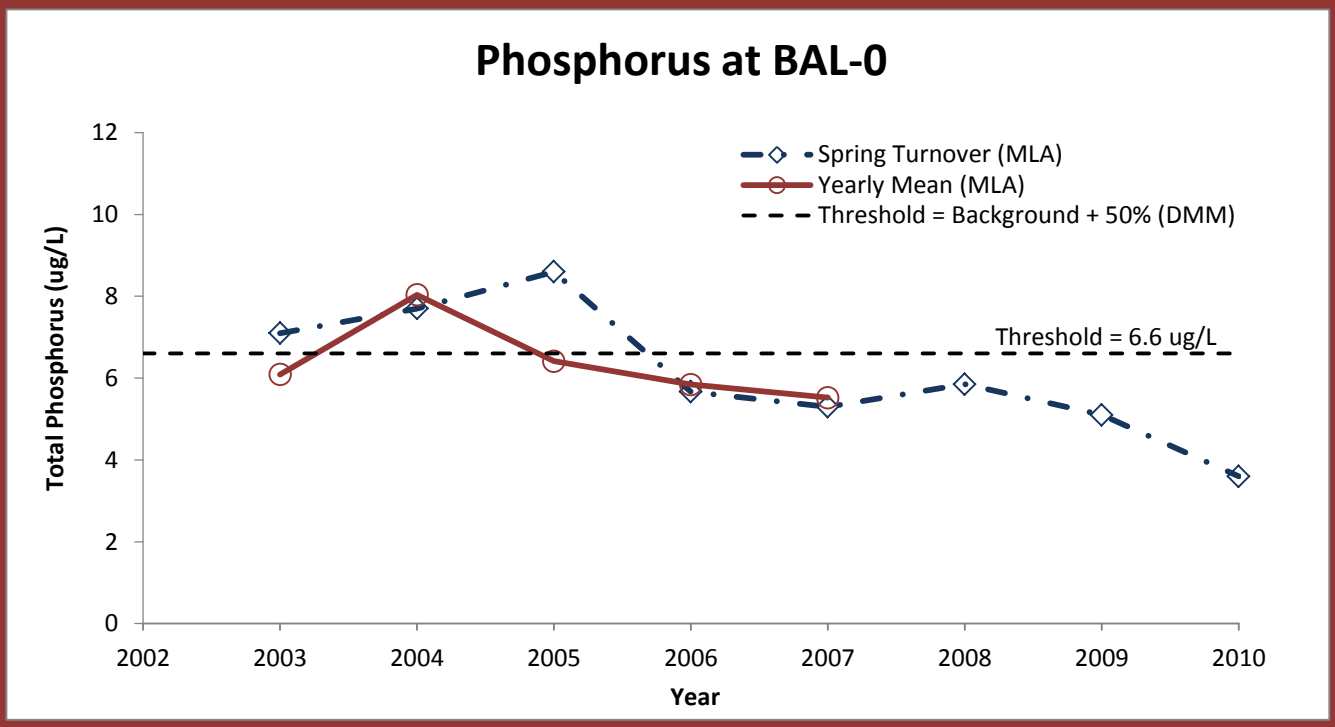
Monitoring of Bala Bay started in 2003. The spring turnover phosphorus concentration at BAL-0 has been trending downwards since 2005. In 2010, the measured concentration was well below the threshold value.

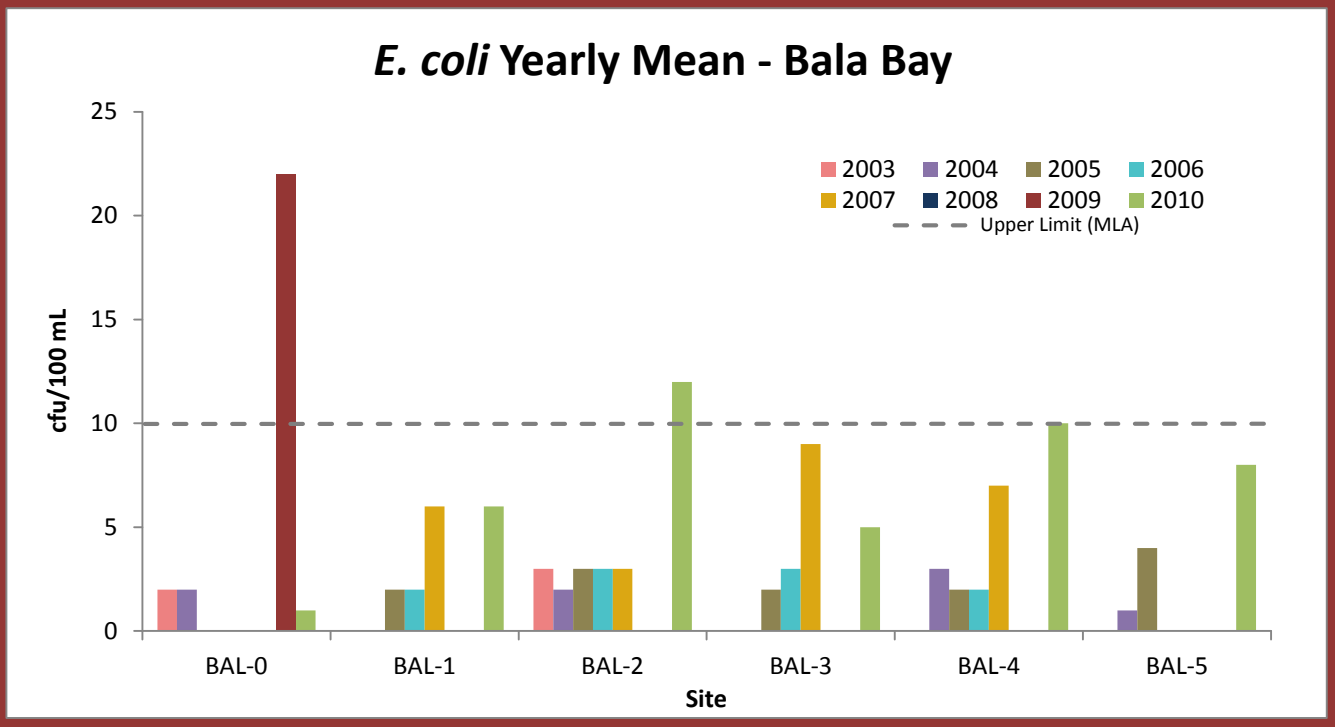
E. coli levels at BAL-2, 4 and 5 were elevated compared to previous years.

Comments and/or Recommendations

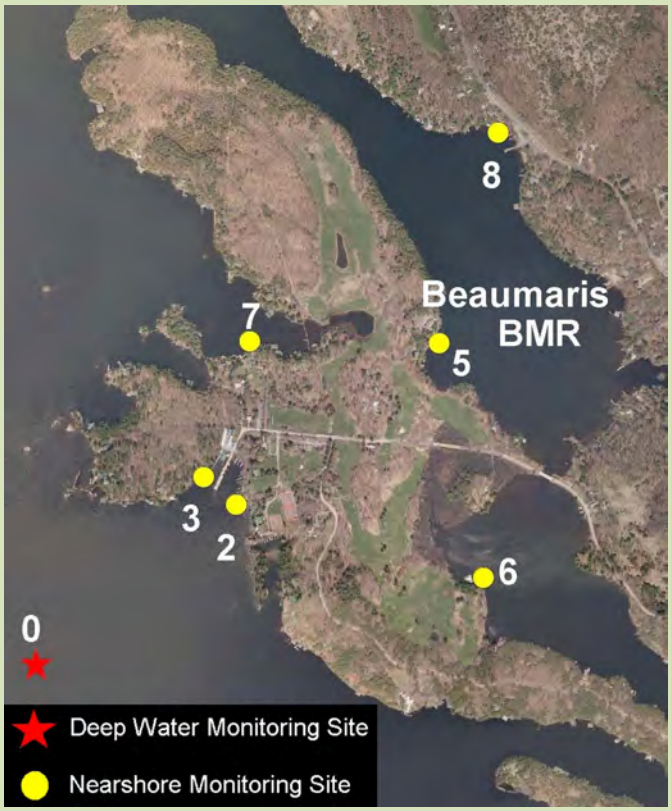
In 2010, BAL-2 and BAL-4 had seasonal *E.coli* averages equal to and above the MLA upper limit, respectively. Document land use adjacent to these sites during sampling in 2011.

(BAL) BALA BAY


Phosphorus at BAL-0
Total Phosphorus (ug/L)
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
Threshold = 6.6 ug/L


E. coli Yearly Mean - Bala Bay
cfu/100 mL
25
20
15
10
5
0
BAL-0
BAL-1
BAL-2
BAL-3
BAL-4
BAL-5
Site
2003
2004
2005
2006
2007
2008
2009
2010
Upper Limit (MLA)

BEAUMARIS (BMR)



Area Description

This island in the Milford Bay area of northeastern Lake Muskoka is approximately 132 ha in size. A golf course takes up much of the island, which is associated with a resort and marina. Most of the natural shoreline vegetation is intact, but there are many large boathouses in this area. There is a large wetland to the east where the causeway joins the mainland and island. BMR-8 is located near the mainland where Milford Bay Road is in close proximity to Lake Muskoka.

Volunteer Recognition

Beaumaris was monitored in 2010 by Cameron Cragg, Chris Cragg, **Louise Cragg**, and Allen Flye.

2010 Data

BMR-0: TP-Spring turnover = 7.7 µg/L
TP-Yearly mean = 5.2 µg/L
Secchi = 3.1 m
Total coliforms = 57 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BMR-2: TP-Yearly mean = 6.7 µg/L
Total coliforms = 134 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

BMR-3: Total coliforms = 174 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BMR-5: TP-Yearly mean = 6.5 µg/L
Total coliforms = 138 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BMR-6: TP-Yearly mean = 7.3 µg/L
Total coliforms = 139 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

BMR-7: TP-Yearly mean = 5.5 µg/L
Total coliforms = 188 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

BMR-8: TP-Yearly mean = 6.4 µg/L
Total coliforms = 123 cfu/100 mL
Total *E. coli* = 7 cfu/100 m

Trends

Monitoring of Beaumaris started in 2002. Spring turnover and yearly mean TP levels have fluctuated since 2002. In 2010, *E. coli* levels were below the MLA upper limit at all sites.

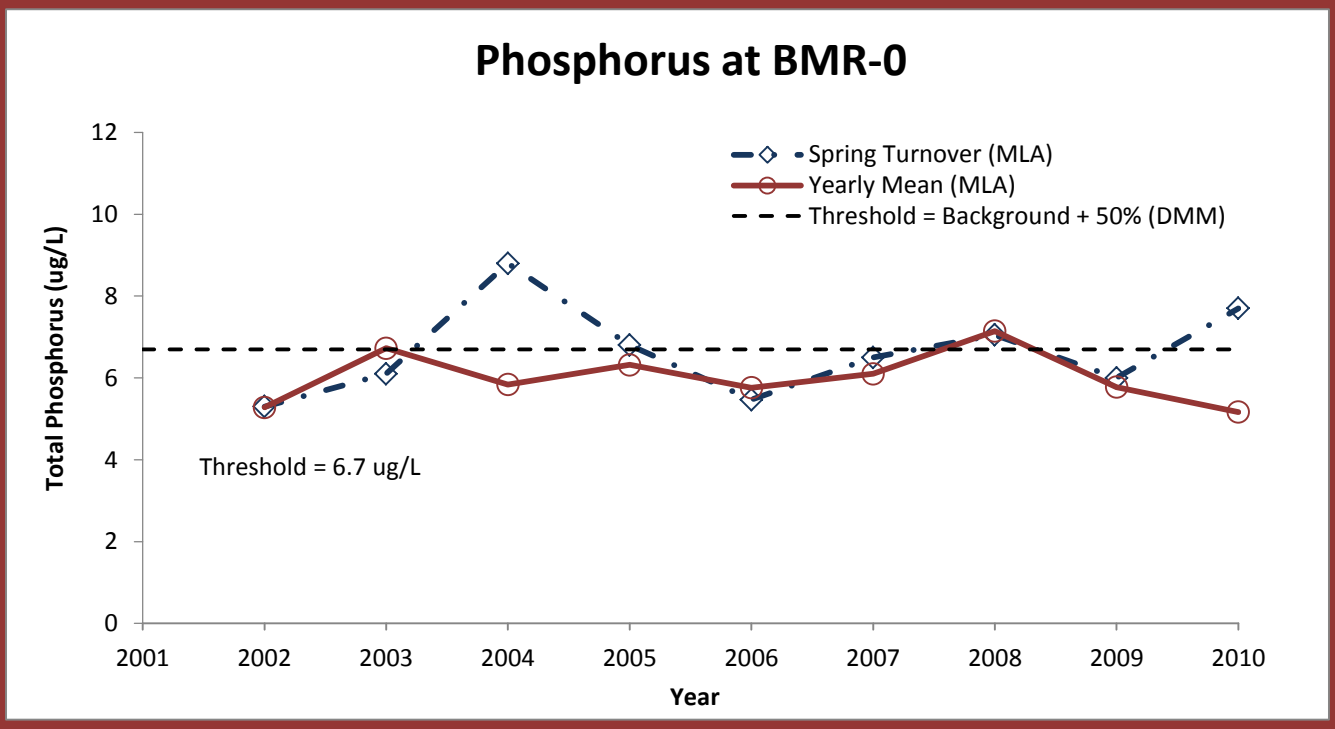
Comments and/or Recommendations

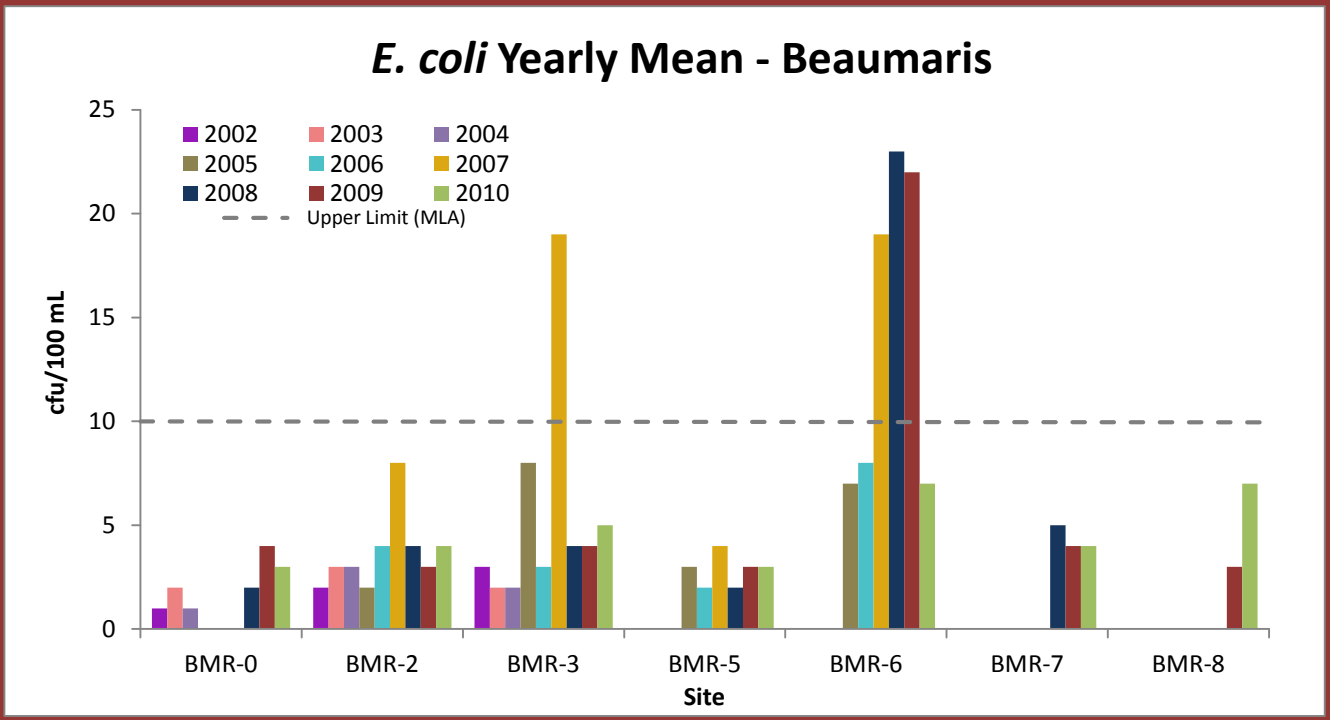
Nearshore sampling did not detect land-based influences on nearshore phosphorus.

Continue sampling spring turnover phosphorus to monitor long-term trends.

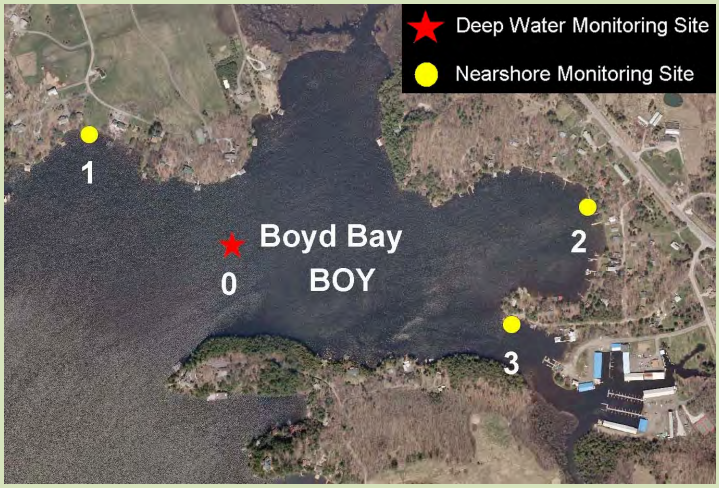
3+ years of sampling has not indicated a bacterial issue; consider discontinuing sampling at BMR-2, 3, 5 and 7 and establishing new sampling sites.

(BMR) BEAUMARIS





BOYD BAY (BOY)



Area Description

Boyd Bay is a small bay in the central part of eastern Lake Muskoka. The water quality in Boyd Bay is influenced by several natural and man-made features, including a marina in the southeast, a large wetland in the north, Highway 118 to the east and several inflowing creeks. The creeks that drain into the bay are potentially influenced by agricultural areas. Much of the shoreline is developed and many residential properties have manicured lawns along the shoreline.

Volunteer Recognition

Boyd Bay was monitored in 2010 by Chris Blaymires, Rayma Blaymires, Lynn Langford, Dave Langford, and **John Wood**.

2010 Data

BOY-0: TP-Spring turnover = 6.3 µg/L
TP-Yearly mean = 6.5 µg/L
Secchi = 3.7 m
Total coliforms = 44 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BOY-1: TP-Yearly mean = 7.2 µg/L
Total coliforms = 92 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BOY-2: TP-Yearly mean = 7.6 µg/L
Total coliforms = 113 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BOY-3: TP-Yearly mean = 14.5 µg/L
Total coliforms = 235 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

Trends

Monitoring of Boyd Bay started in 2006. Yearly mean phosphorus and spring turnover phosphorus levels have trended downward since 2006 and 2008, respectively.

2010 *E. coli* levels remained well below the MLA upper limit at all sites, mainly falling within the ranges observed from 2006-2009. Total coliform levels at BOY-3 were elevated compared to other sites in this sampling area.

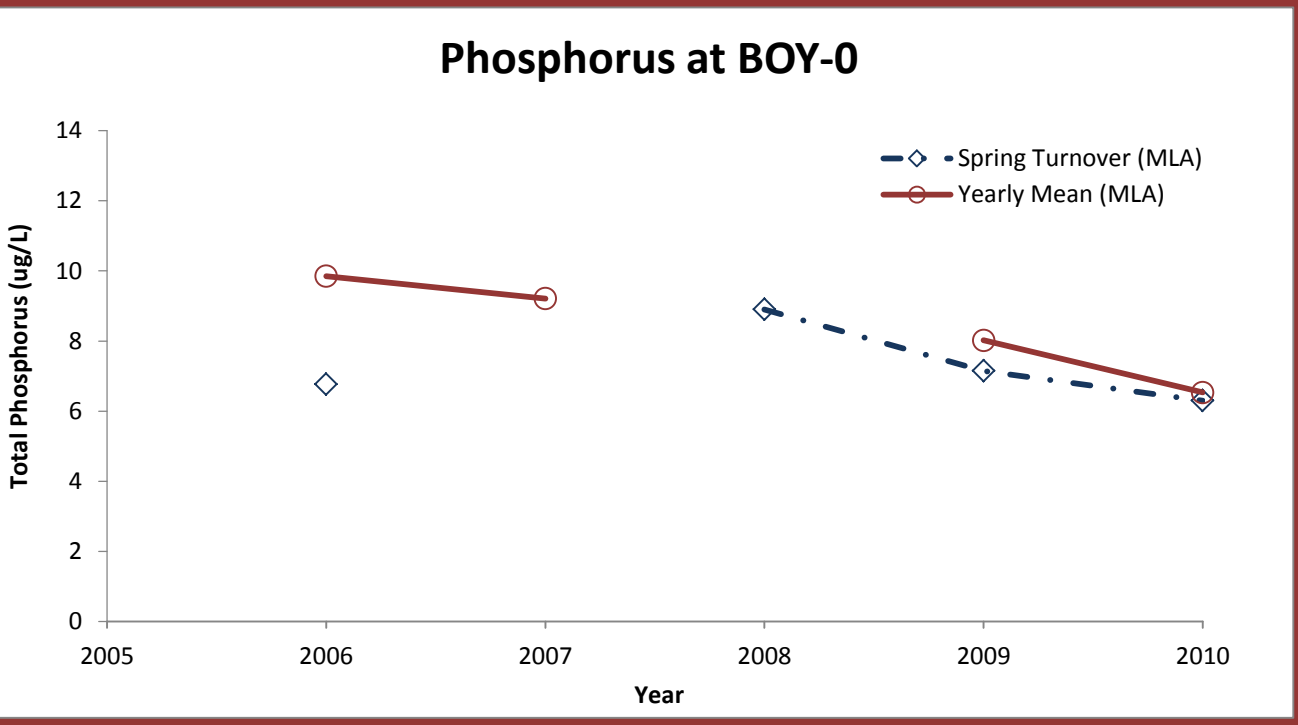
Comments and/or Recommendations

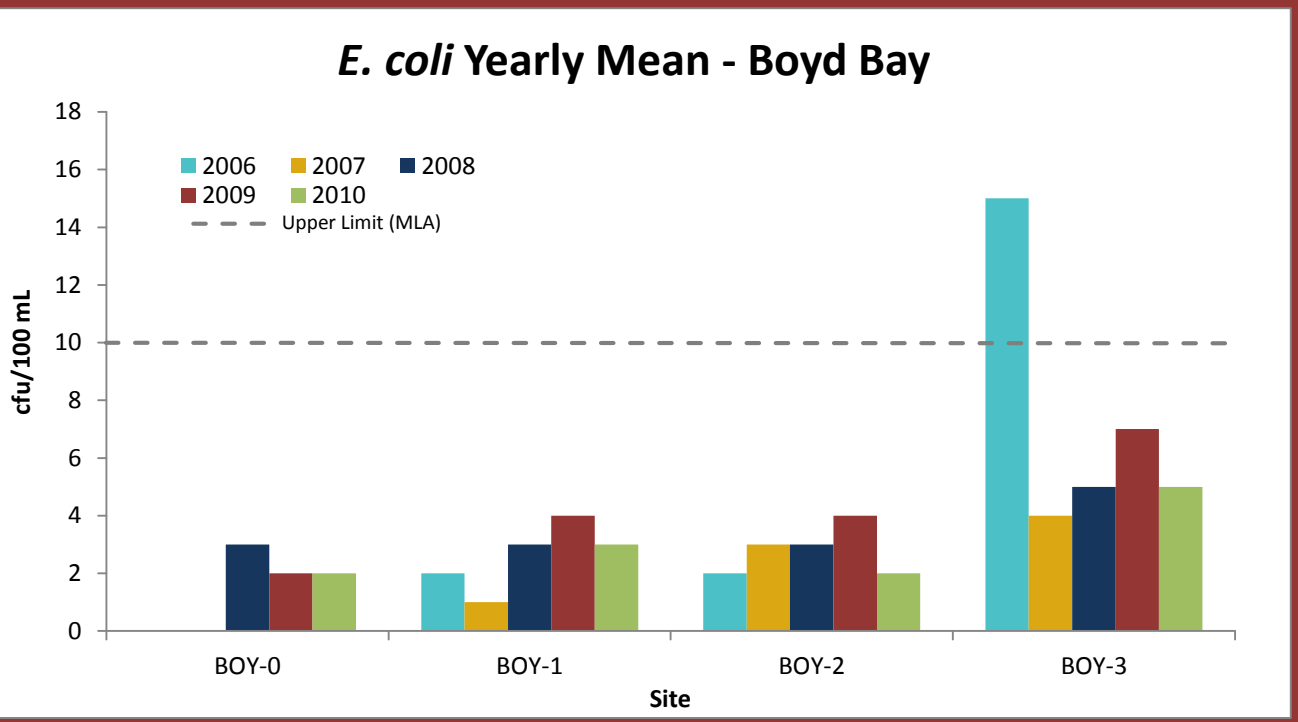
Nearshore sampling at BOY-3 suggests potential land-based influences on nearshore phosphorus.

In 2011, document land use adjacent to BOY-3 and continue to monitor nearshore TP at this site.

3+ years of sampling has not indicated a bacterial issue; consider discontinuing sampling at BOY-1 and BOY-2 and establishing new sampling sites.

(BOY) BOYD BAY


Phosphorus at BOY-0
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
14
2005
2006
2007
2008
2009
2010
Year
Spring Turnover (MLA)
Yearly Mean (MLA)


E. coli Yearly Mean - Boyd Bay
cfu/100 mL
0
2
4
6
8
10
12
14
16
18
2006
2007
2008
2009
2010
Upper Limit (MLA)
BOY-0
BOY-1
BOY-2
BOY-3
Site

DUDLEY BAY (MUS-2)

Area Description

Dudley Bay is located in eastern Lake Muskoka, and is approximately 3.6 km² in size with a maximum depth of 20 m. It is considered moderately developed, with primarily residential properties and several roads, including Highway 169, that are in close proximity to the shoreline. Several creeks and wetlands drain into the bay, including that from the cranberry marsh. Dudley Bay is classified as moderately sensitive by the DMM.

Volunteer Recognition

Dudley Bay was monitored in 2010 by Eleanor Lewis and Jim Lewis.

2010 Data

MUS-2: TP-Spring turnover = 3.8 µg/L
Secchi = 4.8 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

Monitoring of Dudley Bay started in 2005.

Spring turnover phosphorus data for 2007 through 2010 suggests that there is a downward trend.

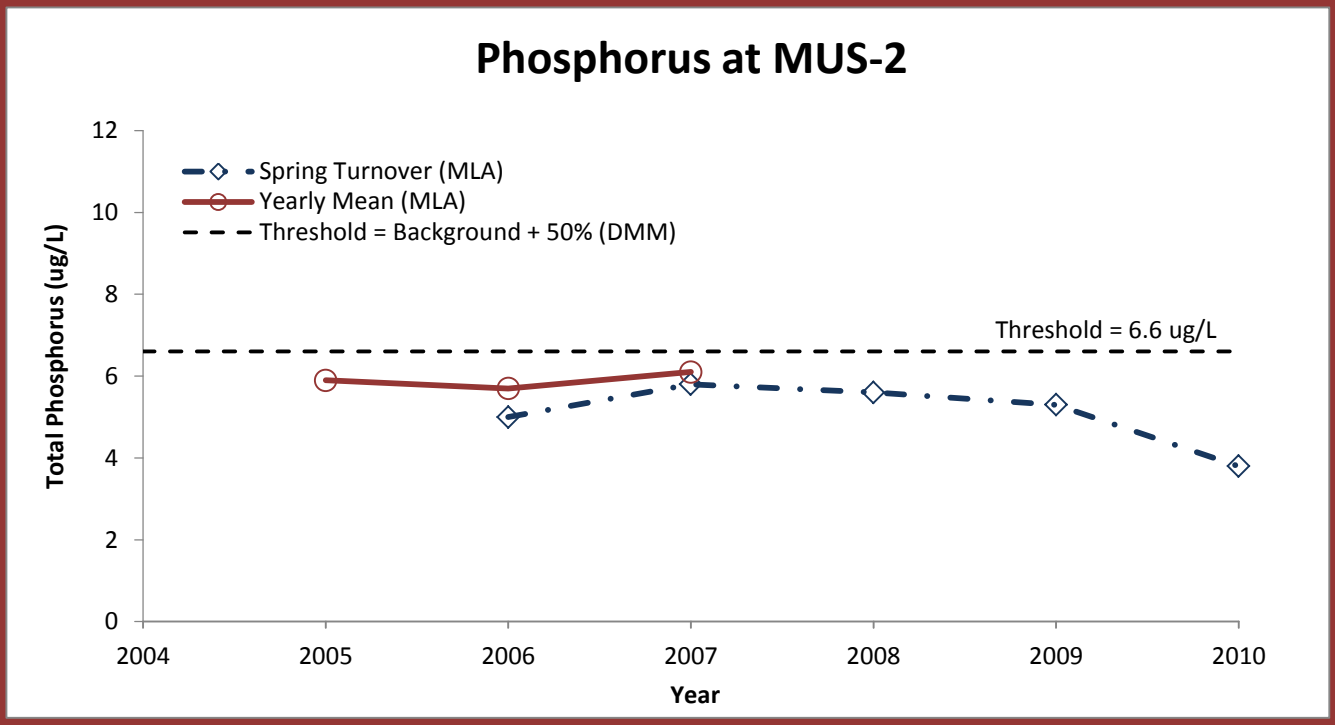
The 2010 spring turnover phosphorus measurement is the lowest on record for this area.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

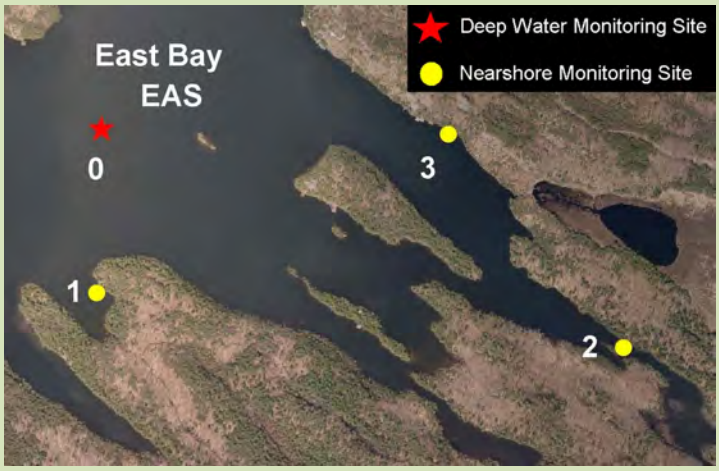
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(MUS-2) DUDLEY BAY



Notes:

EAST BAY (EAS)



Area Description

East Bay is in the western portion of Lake Muskoka and is part of Hardy Lake Provincial Park. This is a low development area with very few cottages/residences and no access roads. Several long narrow bays form the drainage area where five creeks outlet into the main bay from the park. These creeks also drain wetland areas into East Bay.

Volunteer Recognition

East Bay was monitored in 2010 by **Louise Cragg**, Chloë Getson, Dave Getson, Gary Getson, Janice Getson, Nolan Getson, Joe Kaminskas, and Lloyd Walton.

2010 Data

EAS-0: TP-Spring turnover = 4.6 µg/L
TP-Yearly mean = 4.6 µg/L
Secchi = 3.8 m
Total coliforms = 57 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

EAS-1: TP-Yearly mean = 5.3 µg/L
Total coliforms = 56 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

EAS-2: TP-Yearly mean = 8.8 µg/L
Total coliforms = 156 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

EAS-3: TP-Yearly mean = 4.7 µg/L
Total coliforms = 55 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

Trends

Monitoring of East Bay started in 2002. Total phosphorus values were variable from 2002-2007, however there has been a general downward trend from 2008-2010.

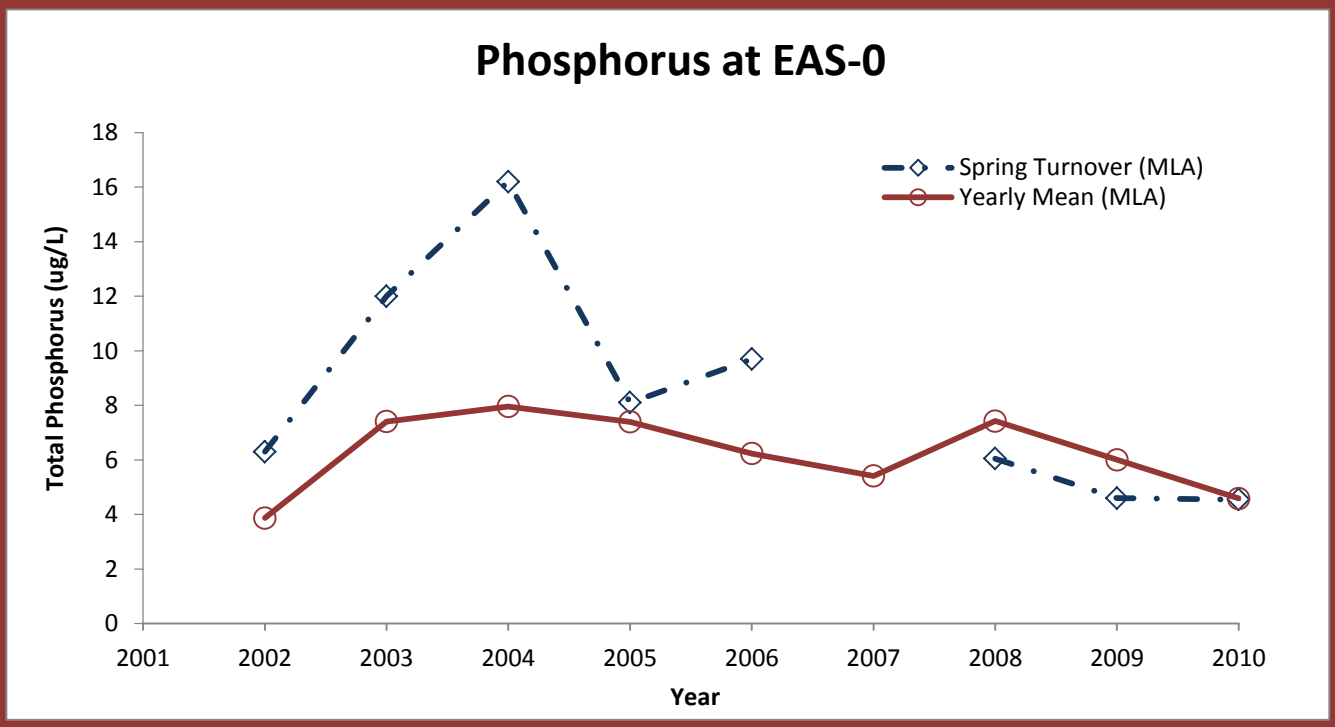
In 2010, *E. coli* measurements were equal or lower than those observed in the previous three years for each site The reduction in *E. coli* numbers was particularly evident at EAS-2.

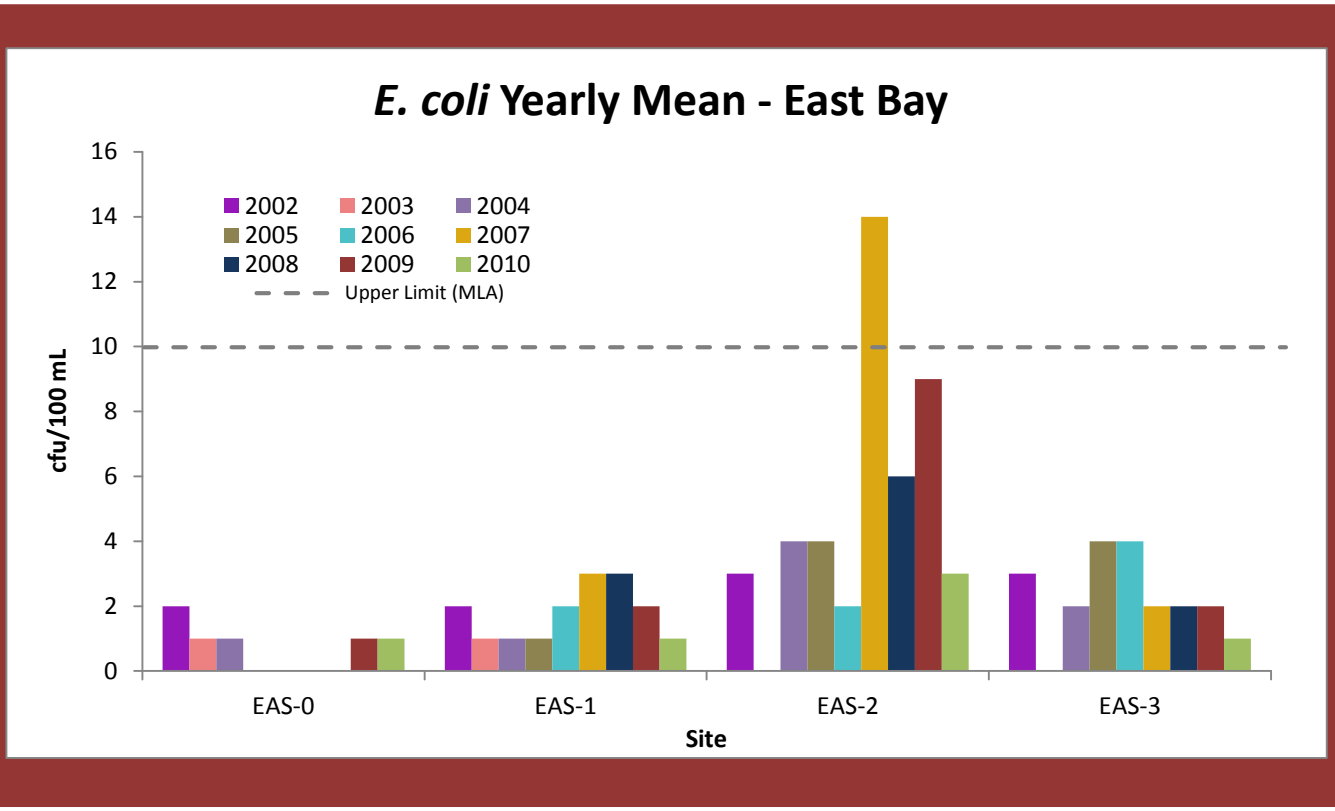
Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

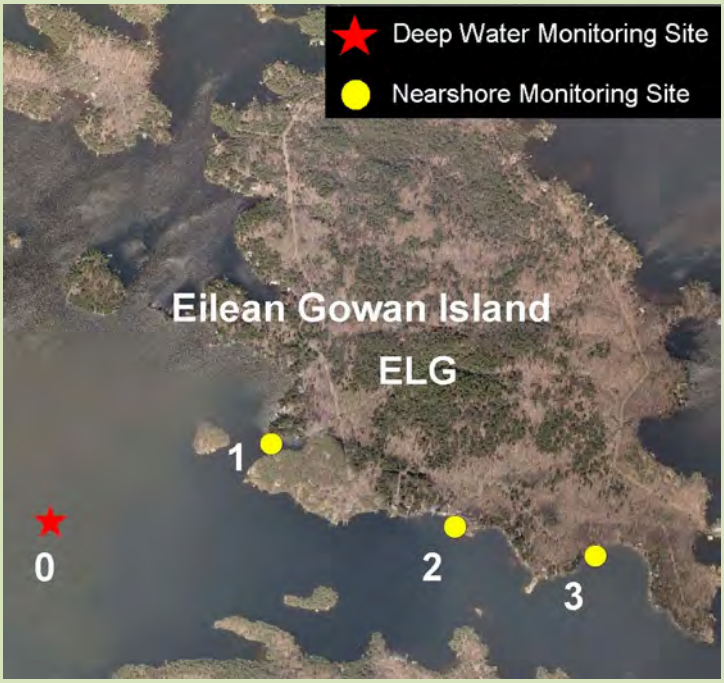
7+ years of sampling has not indicated a bacterial issue; consider discontinuing sampling at EAS-1 and EAS-3 and establishing new sampling sites.

(EAS) EAST BAY


Phosphorus at EAS-0
Total Phosphorus (ug/L)
18
16
14
12
10
8
6
4
2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Spring Turnover (MLA)
Yearly Mean (MLA)


E. coli Yearly Mean - East Bay
cfu/100 mL
16
14
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
Upper Limit (MLA)
EAS-0
EAS-1
EAS-2
EAS-3
Site

EILEAN GOWAN ISLAND (ELG)



Area Description

Eilean Gowan Island is located in the eastern part of Lake Muskoka and is largely developed with residential cottages. Most of these properties appear to retain a well-vegetated shoreline with the exception of a few lawns and tennis courts directly adjacent to the lake. The interior of this island is completely forested and two small streams outlet from upland areas at sampling sites ELG-1 and ELG-3.

Volunteer Recognition

Eilean Gown Island was monitored in 2010 by Sam Crabbe, **Susan Murphy**, Taylor Salisbury, Alastair Sims, Andrew Sims, Stephen Sims, Sydney Sims, Beth Tate, Doug Tate, and Katie Wills.

2010 Data

ELG-0: TP-Spring turnover = 6.2 µg/L
Secchi = 3.6 m
Total coliforms = 5 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

ELG-1: Total coliforms = 49 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

ELG-2: Total coliforms = 61 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

ELG-3: Total coliforms = 55 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

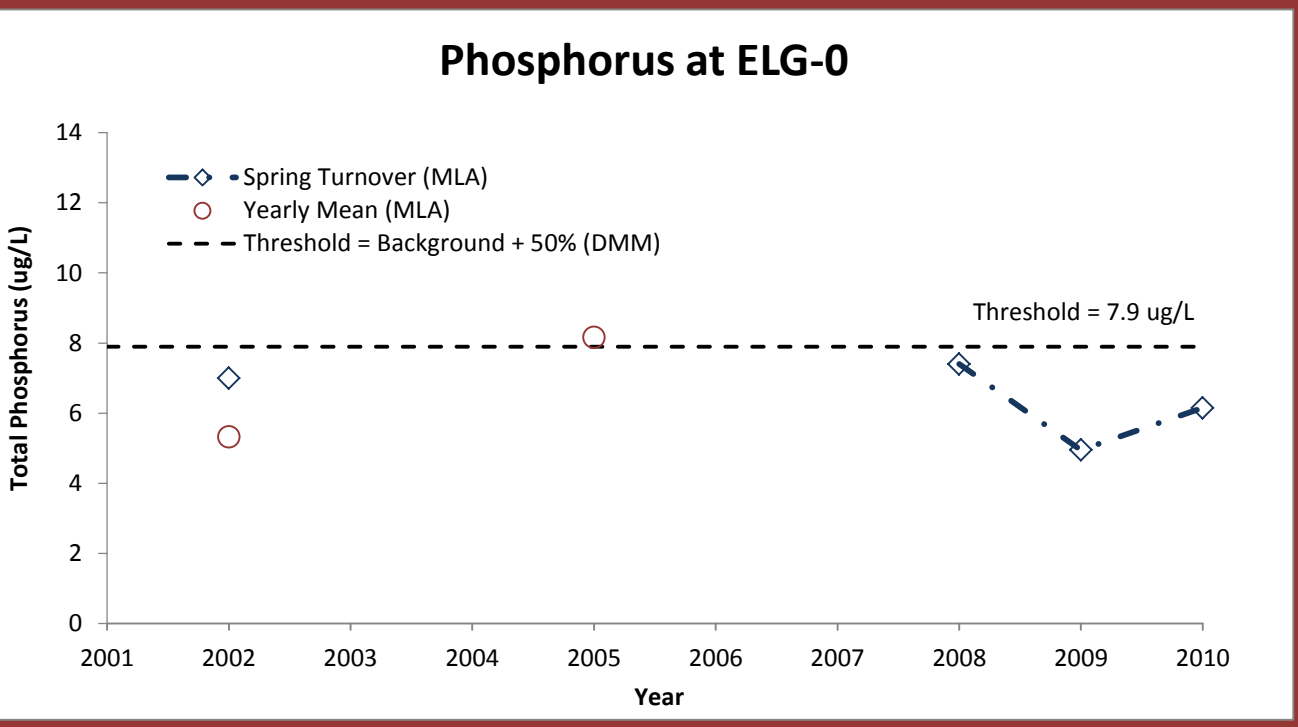
Monitoring of Eilean Gowan Island started in 2002, however there is limited data available from 2002-2007. Spring turnover phosphorus has been variable over the period of 2008-2010 .

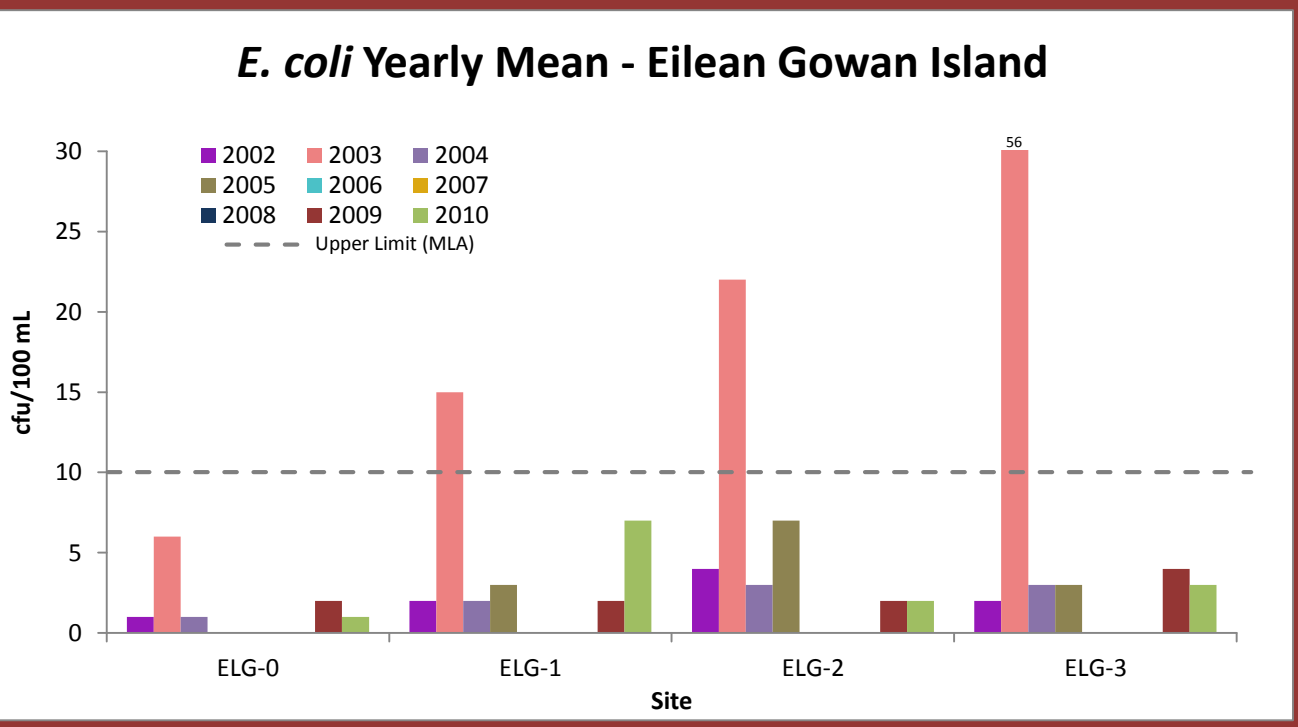
2010 *E. coli* values were consistent with those obsesrved in previous years with 2003 being the lone exception. Results at all sites were below the MLA upper limit.

Comments and/or Recommendations

Continue sampling spring turnover phosphorus to monitor long-term trends.

(ELG) EILEAN GOWAN ISLAND





MUSKOKA BAY (MBA)

Area Description

Muskoka Bay is the southernmost bay in Lake Muskoka. The bay has a long history of industrial uses and nutrient issues. While water quality in the bay has improved dramatically since the 1970s, it is still classified as moderately sensitive and over threshold by the DMM. Although the bay has a high intensity of development, 80% of the shoreline is presently in a natural state. The southern end of this bay includes a large commercial development and is the receiver of most of Gravenhurst's urban storm water. Several creeks outlet into the bay and wetlands account for 9.4% of the shoreline.

Volunteer Recognition

Muskoka Bay was monitored in 2010 by George Genereux, **Brian Yeates**, and **Diane Yeates**.

2010 Data

MBA-0: TP-Spring turnover = 9.3 µg/L
TP-Yearly mean = 8.2 µg/L
Secchi = 3.7 m

MBA-3: TP-Yearly mean = 13.8 µg/L
Total coliforms = 124 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MBA-4: TP-Yearly mean = 10.7 µg/L
Total coliforms = 127 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MBA-5: Total coliforms = 262 cfu/100 mL
Total *E. coli* = 12 cfu/100 mL

MBA-9: TP-Yearly mean = 8.7 µg/L
Total coliforms = 142 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

MBA-11: TP-Yearly mean = 8.1 µg/L
Total coliforms = 84 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MBA-12: TP-Yearly mean = 22.8 µg/L
Total coliforms = 1214 cfu/100 mL
Total *E. coli* = 170 cfu/100 mL

Trends

Monitoring of Muskoka Bay started in 2002. Since then, spring turnover and yearly mean phosphorus concentrations have fluctuated.

2010 *E. coli* levels at MBA-5 and MBA-12 were above the upper limit.

Comments and/or Recommendations

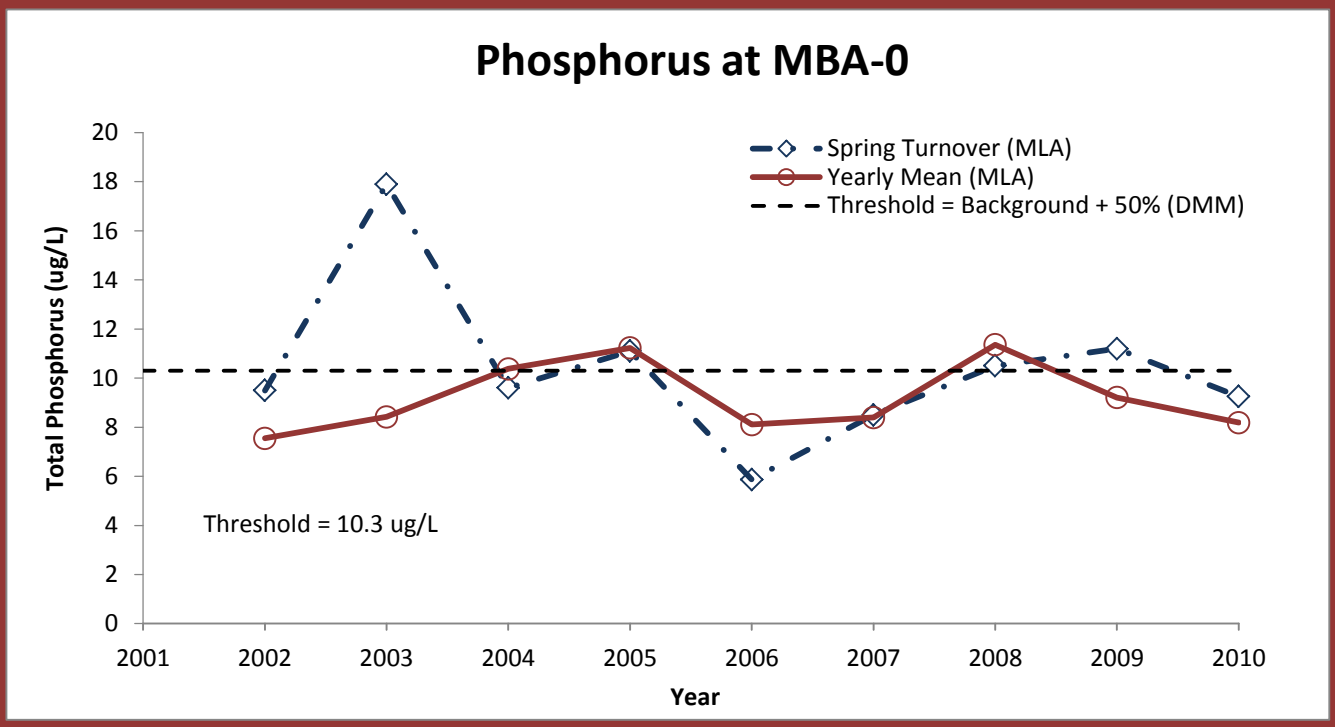
Nearshore sampling at MBA-12 suggests potential land-based influences on nearshore phosphorus.

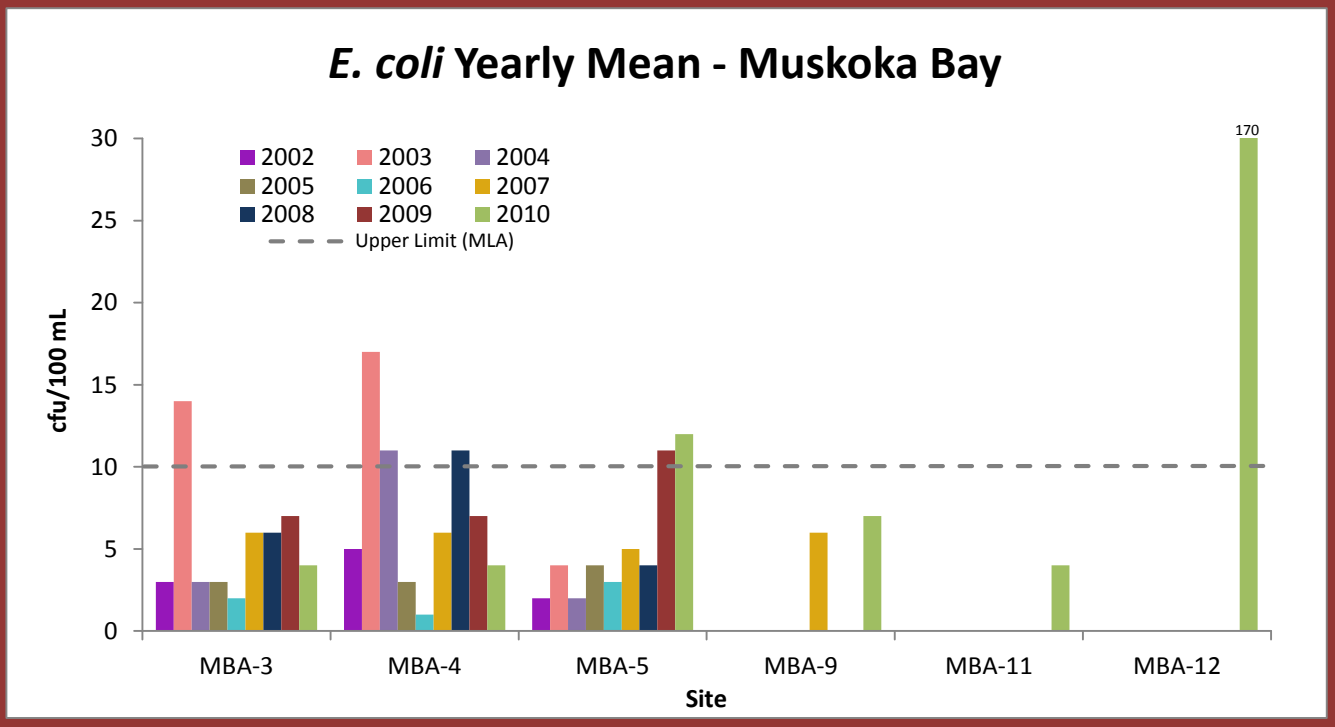
Continue sampling MBA-12 and develop a detailed research plan to collect more data.

Participate in the OBBN again in 2011 to allow for comparison with 2007 data.

Work with the Stewardship Coordinator to prepare a plan to discuss water quality issues with the Town in 2011.

(MBA) MUSKOKA BAY





MUSKOKA SANDS (MSN)

Area Description

The Muskoka Sands sampling area is located in southeastern Lake Muskoka at the confluence with the Hoc Roc River. This area has a high intensity of development with a large resort with golf course, along with a high density of residential properties and roads adjacent to the lake. The Hoc Roc River flows through agricultural, industrial, residential and natural wetland areas before it drains into a shallow bay. Dominant northwest winds and a considerable fetch would subject this area to heavy onshore wave action.

Volunteer Recognition

Muskoka Sands was monitored in 2010 by **Al Ward** and **Carole Ward**.

2010 Data

MSN-0: TP-Spring turnover = 5.7 µg/L
Secchi = 4.2 m
Total coliforms = 4 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MSN-1: Total coliforms = 74 cfu/100 mL
Total *E. coli* = 23 cfu/100 mL

MSN-2: Total coliforms = 80 cfu/100 mL
Total *E. coli* = 20 cfu/100 mL

MSN-3: Total coliforms = 18 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MSN-4: TP-Yearly mean = 49.7 µg/L
Total coliforms = 164 cfu/100 mL
Total *E. coli* = 103 cfu/100 mL

Trends

Monitoring of Muskoka Sands started in 2003. Spring turnover phosphorus concentrations have remained stable over 2009-2010.

2010 *E. coli* values were elevated at MSN-1 and MSN-2, while those observed at MSN-4 were extremely high.

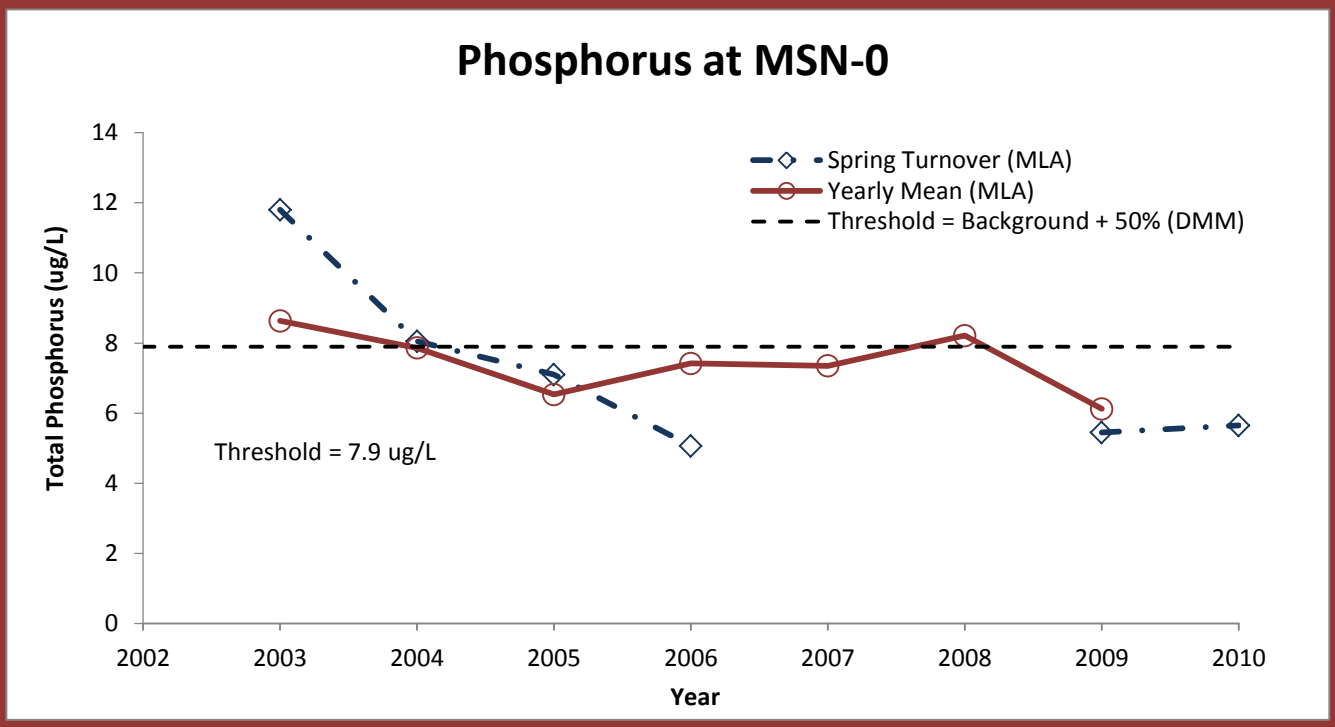
Comments and/or Recommendations

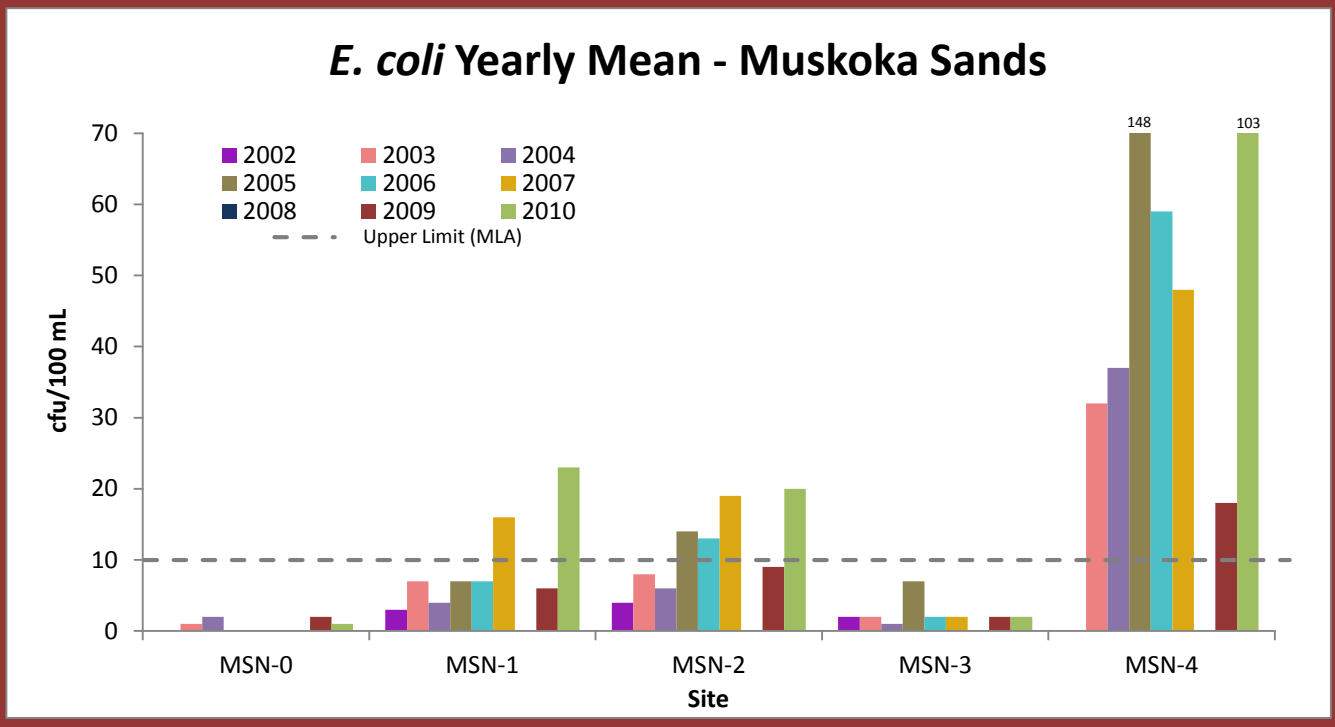
Nearshore sampling at MSN-4 suggests potential land-based influences on nearshore phosphorus.

MSN-4 is located in the Hoc Roc River, approximately 700m upstream of the outlet to Lake Muskoka. A second site on the Hoc Roc located at Jones Rd. should be established in 2011. Both phosphorus and bacteria should be monitored at this new site.

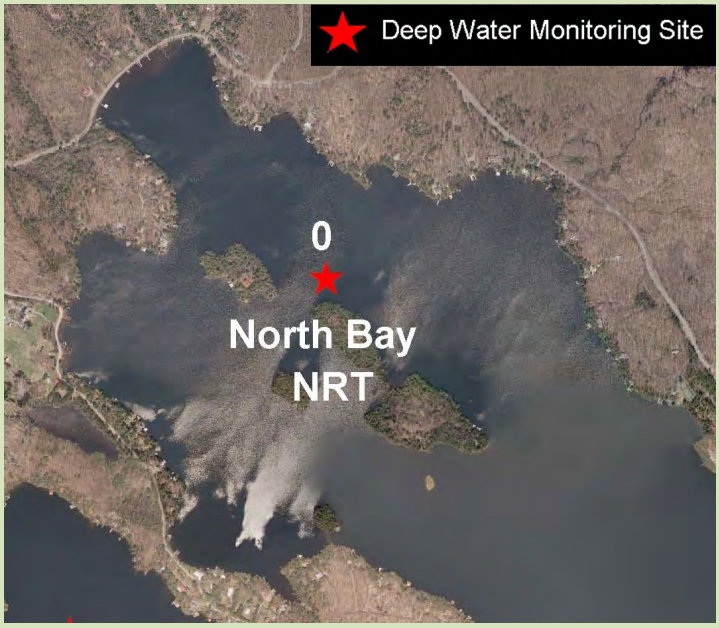
OBBN data suggests that water quality at Muskoka Sands is below the Muskoka average.

(MSN) MUSKOKA SANDS





NORTH BAY (NRT)



Area Description

The North Bay sampling area is a large bay in northwestern Lake Muskoka. A total of eight creeks outlet into the bay, several draining wetland areas and one that passes through a District landfill site north of the lake. This is a moderately developed part of the lake, having many residential properties and several roads that are in close proximity to the shoreline. Development is mostly restricted to the areas adjacent to the lake, leaving most of the upland forested areas in a natural state.

Volunteer Recognition

North Bay was monitored in 2010 by Eleanor Lewis and Jim Lewis.

2010 Data

NRT-0: TP-Spring turnover = 4.2 µg/L
Secchi = 4.3 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

Monitoring of North Bay started in 2005.

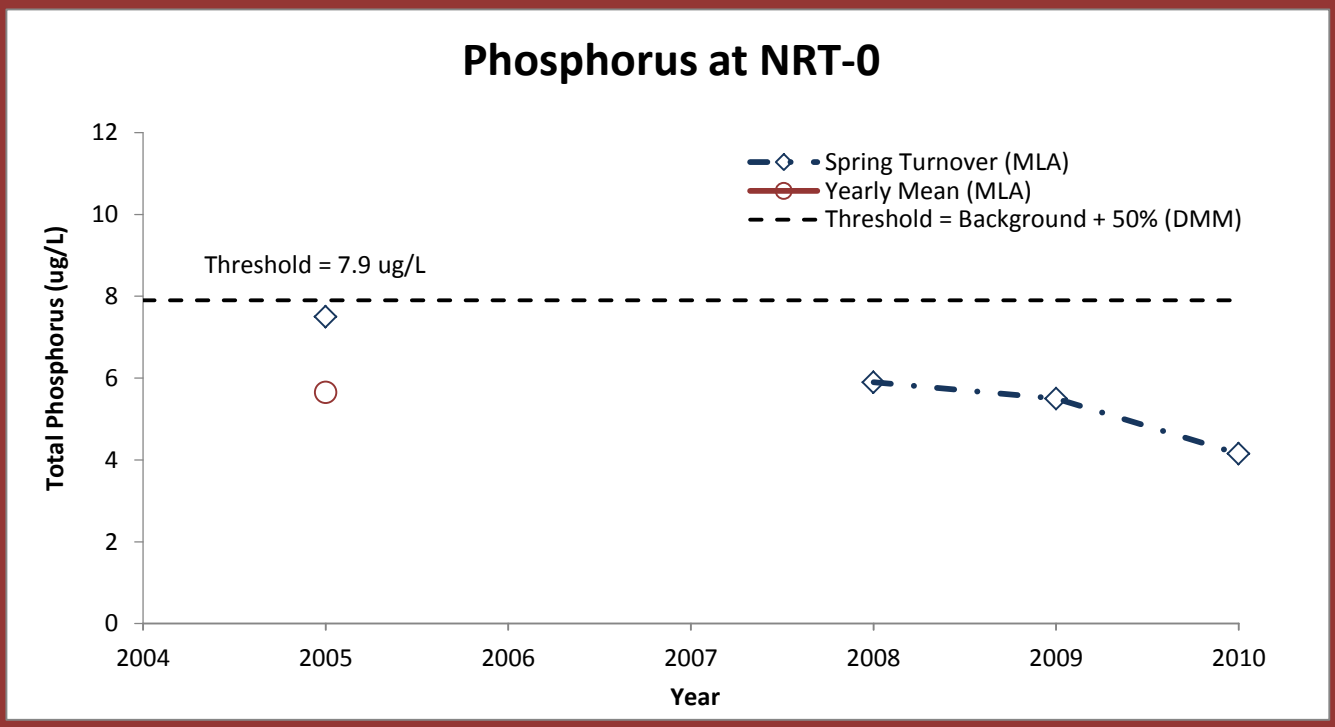
Spring turnover phosphorus concentrations have trended downward since 2008, remaining below the threshold value.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(NRT) NORTH BAY



Notes:

WHITESIDE BAY(WTS)

Area Description

Whiteside Bay is a partially isolated bay in the northwestern portion of Lake Muskoka. It is moderately developed with cottage/residential properties and has roadways that come in close proximity to the shoreline in several areas. Inflow into the lake comes from two creeks, one of which originates in an extensive wetland complex to the north.

Volunteer Recognition

Whiteside Bay was monitored in 2010 by Eleanor Lewis and Jim Lewis.

2010 Data

WTS-0: TP-Spring turnover = 4.7 µg/L
Secchi = 4.3 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

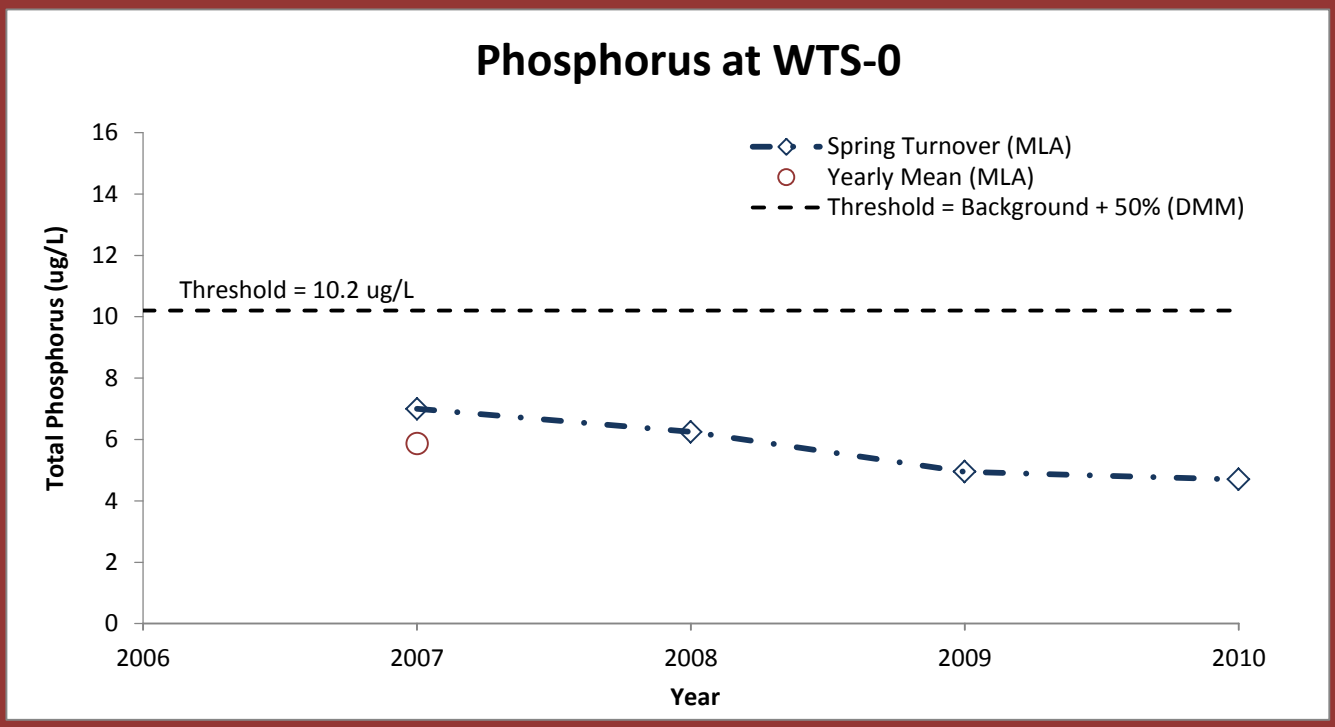
Monitoring of Whiteside Bay started in 2007. Since then, spring turnover phosphorus concentrations have trended downward. All total phosphorus measurements have been below the threshold value.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

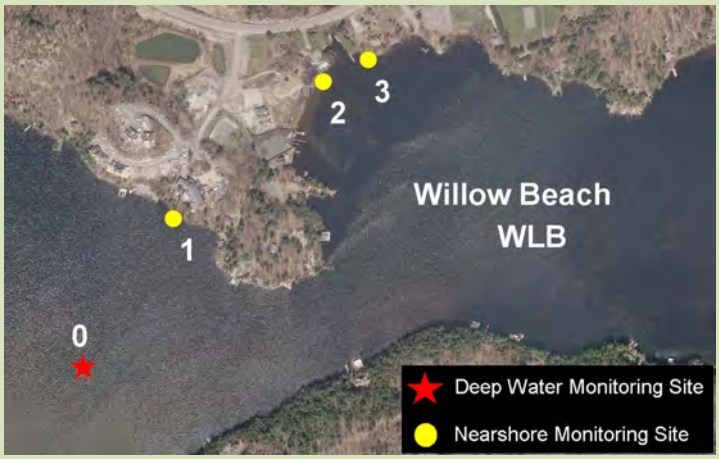
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(WTS) WHITESIDE BAY



Notes:

WILLOW BEACH (WLB)



Area Description

The Willow Beach sampling area encompasses a highly developed section of shoreline. There is a newly re-developed resort complex, a wetland with a creek flowing through a nine-hole golf course and several larger properties with limited retained forest cover. Highway 118 is in close proximity to the shoreline along much of this reach.

Volunteer Recognition

Willow Beach was monitored in 2010 by Liz Denyar, Debbie Hastings, David Sisam, Peter Sisam, and **John Wood**.

2010 Data

WLB-0: TP-Spring turnover = 5.1 µg/L
TP-Yearly mean = 5.7 µg/L
Secchi = 3.3 m
Total coliforms = 29 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

WLB-1: TP-Yearly mean = 5.6 µg/L
Total coliforms = 58 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

WLB-2: TP-Yearly mean = 5.9 µg/L
Total coliforms = 104 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

WLB-3: TP-Yearly mean = 6.3 µg/L
Total coliforms = 71 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

Trends

Monitoring of Willow Beach started in 2004. Since 2008, spring turnover and yearly mean phosphorus concentrations have trended downward.

In 2010, *E. coli* levels were all below the MLA upper limit for the first time since 2005. Results from WLB-2 and WLB-3 were particularly low compared to recent years.

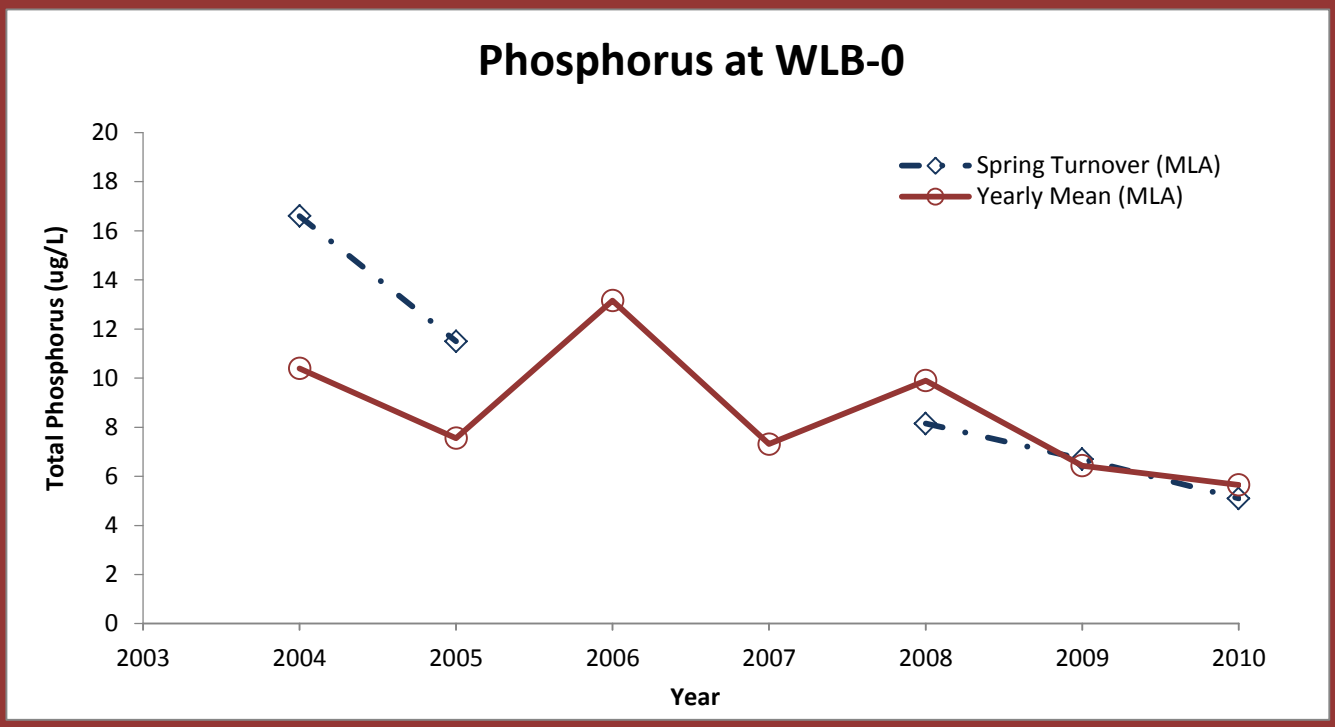
2006 phosphorus data does not include the single spring turnover measurement of 55.3 ug/L

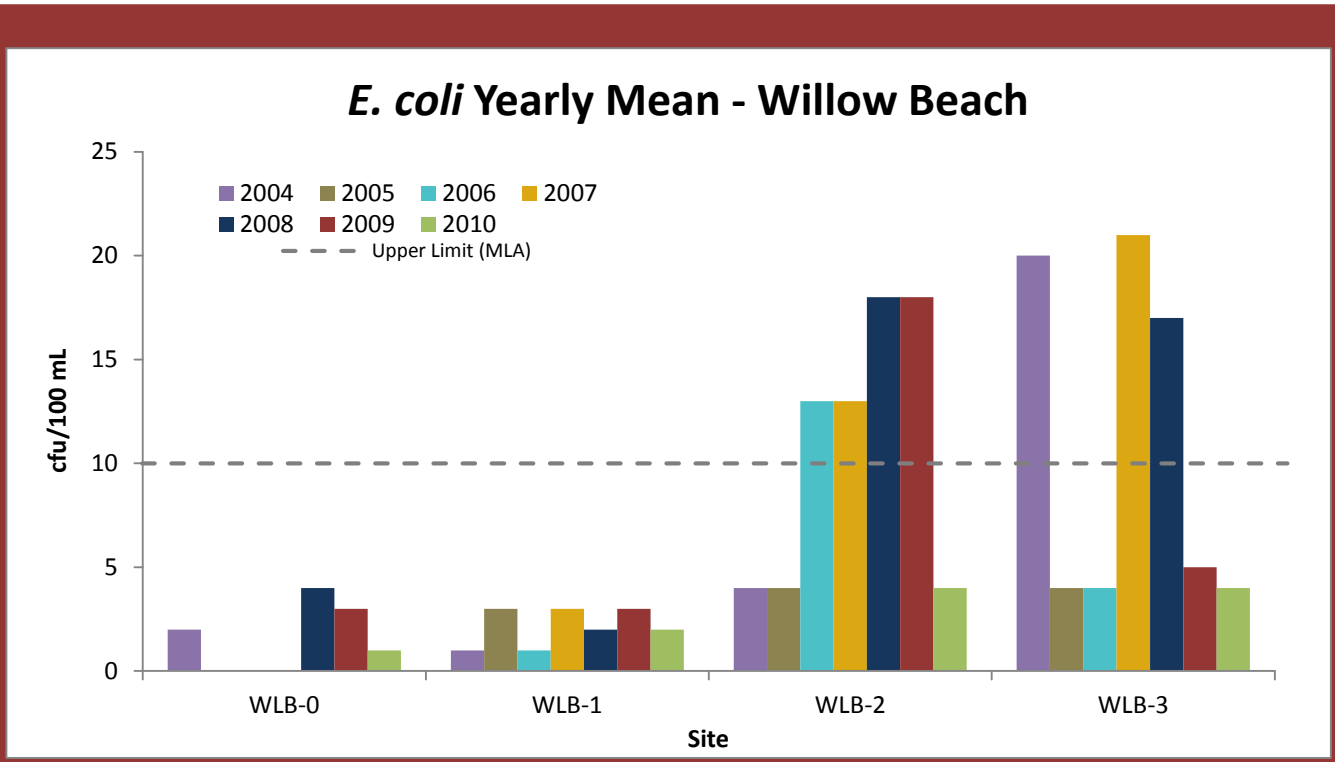
Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

7 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at WLB-1 and establishing a new sampling site.

(WLB) WILLOW BEACH





ARTHURLIE BAY (ART)

Area Description

Arthurlie Bay in is the southern basin of Lake Rosseau. The bay is quite shallow in the southern end. Development intensity is considered moderate to high, with some shoreline properties having extensive cleared areas. This bay has several lacustrine wetlands, some of which appear to be partially filled. One creek drains into the bay, flowing through agricultural land prior to entering the lake.

Volunteer Recognition

Arthurlie Bay was monitored in 2010 by Peter Seybold.

2010 Data

ART-0: TP-Spring turnover = 5.1 µg/L
Secchi = 3.5 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

Monitoring of Arthurlie Bay started in 2002.

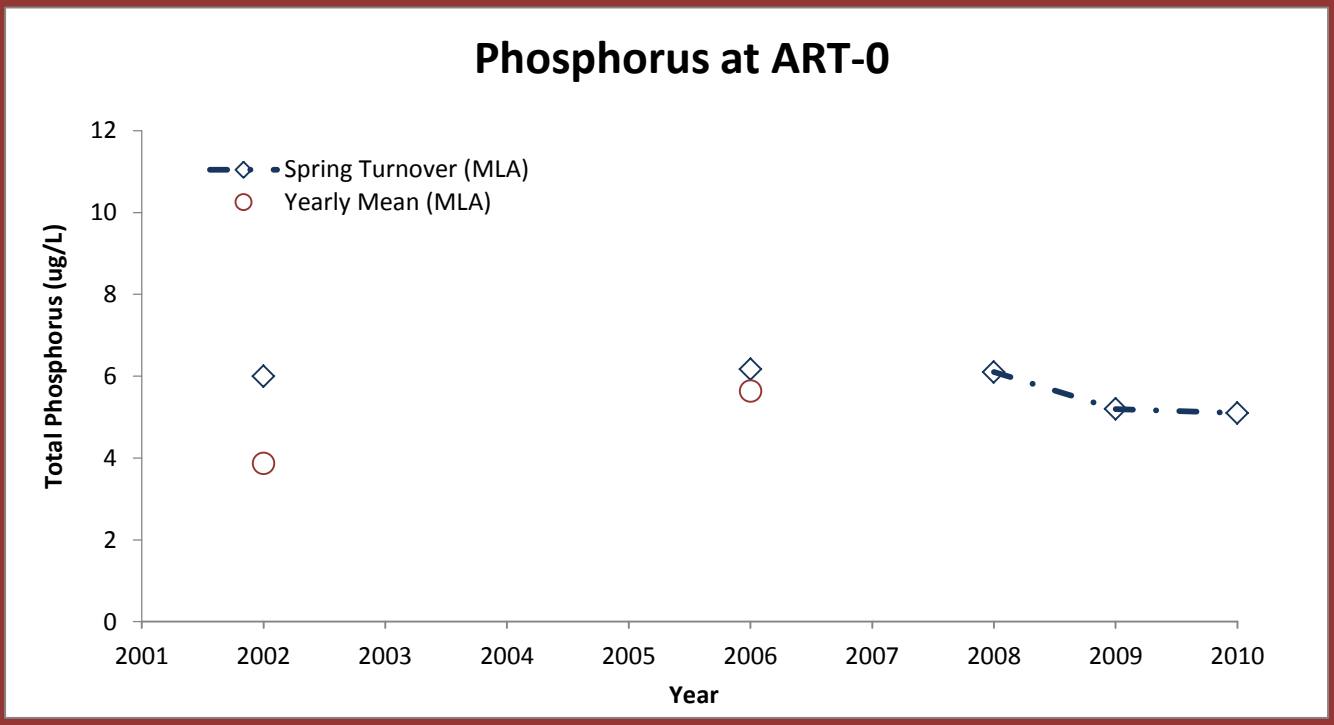
Since 2008, spring turnover phosphorus concentration has trended downward.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

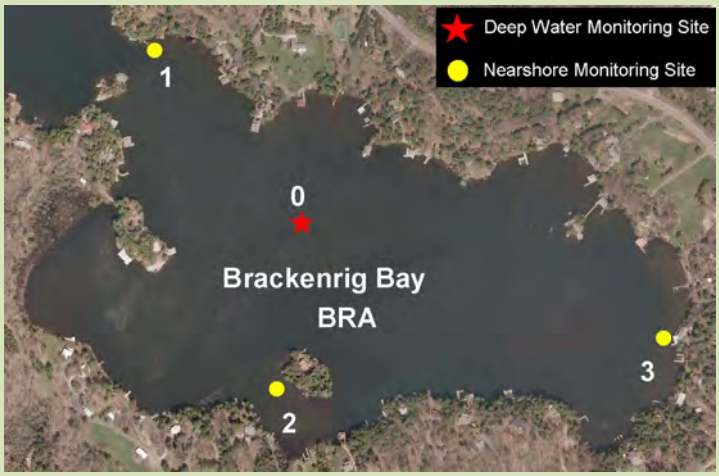
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(ART) ARTHURLIE BAY



Notes:

BRACKENRIG BAY (BRA)



Area Description

Brackenrig Bay is located in southern Lake Rosseau, is approximately 0.44 km² in area and has a maximum depth of 3 m. This isolated bay is moderately developed with residential properties. Approximately 20% of the immediate shoreline has been altered with over 60% of backlot areas cleared of natural forest. Four creeks drain into the bay, one of which flows through an agricultural area adjacent to a garden center before entering the lake. Brackenrig road comes in close proximity to the lake along the northeast shoreline. Brackenrig Bay has been classified as moderately sensitive and over threshold by the DMM.

Volunteer Recognition

Brackenrig Bay was monitored in 2010 by John Hylton, **Gary Poole**, **Marion Poole**, and Ross Wells.

2010 Data*

BRA-0: TP-Yearly mean = 13.0 µg/L**
Secchi = 1.7 m

BRA-1: TP-Yearly mean = 9.6 µg/L
Total coliforms = 41 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

BRA-2: TP-Yearly mean = 9.9 µg/L
Total coliforms = 63 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BRA-3: TP-Yearly mean = 10.6 µg/L
Total coliforms = 16 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

* Phosphorus samples were not collected for weekends 1, 2 or 3. Bacterial samples were not collected for weekends 2 or 3.

** BRA-0 had one total phosphorus measurement of 20.7 µg/L which skewed the yearly mean.

Trends

Monitoring of Brackenrig Bay started in 2003. Both the spring turnover and yearly mean TP levels have been highly variable over this time period. Overall, 2010 *E. coli* levels were similar to previous years and below the MLA upper limit.

Comments and/or Recommendations

Collect TP-spring turnover samples in 2011.

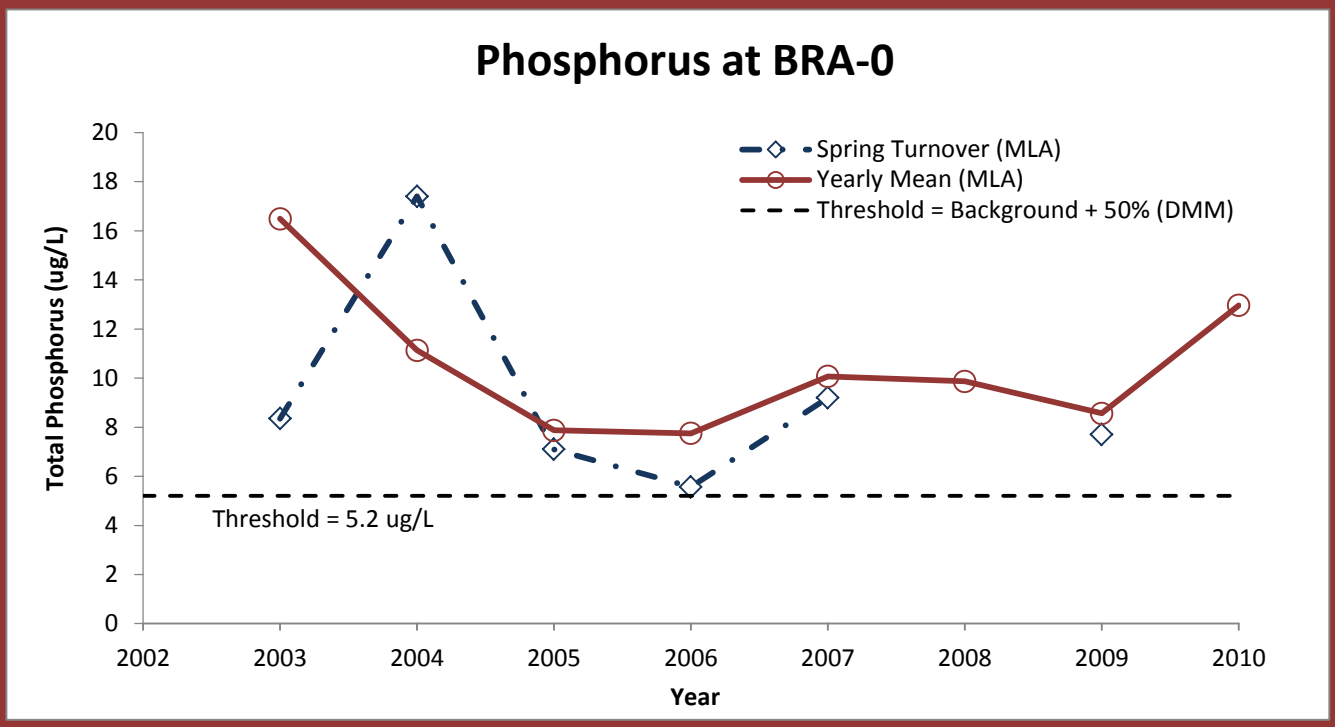
Nearshore sampling did not detect land-based influences on nearshore phosphorus.

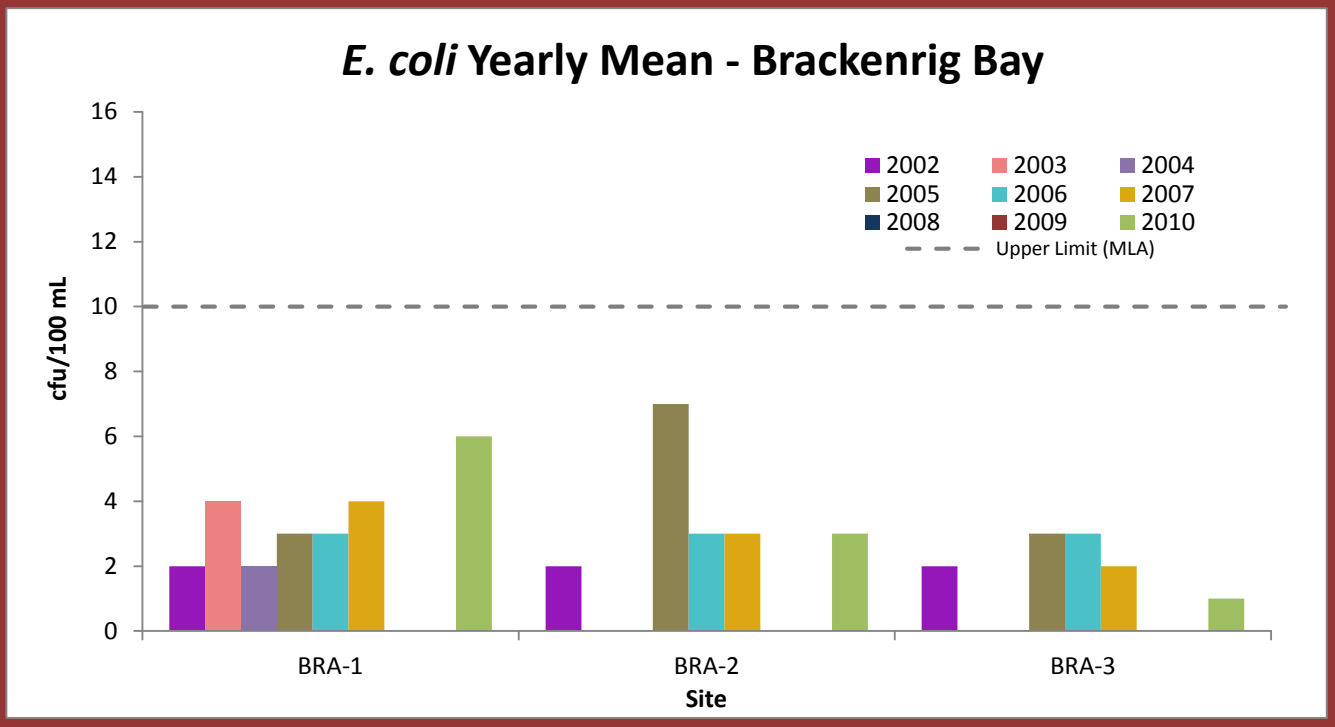
Conduct a shoreline survey to determine the number of properties that would benefit from best management practices.

Participate in the Ontario Benthic Biomonitoring Network again in 2011 to allow for comparison with 2007 data.

It is expected that the DMM will consider remodelling Brackenrig Bay in 2011.

(BRA) BRACKENRIG BAY





EAST PORTAGE BAY (POR)

Area Description

East Portage Bay is located in eastern Lake Rosseau, has an area of approximately 1.33 km², and reaches a maximum depth of 12 m. This moderately developed bay has many roads, with several areas directly adjacent to the shoreline. There is also a large agricultural area adjacent to the northern shoreline of the bay. No creeks outlet into the bay and there are no wetlands draining from the upper watershed. East Portage Bay has been classified as highly sensitive and over threshold by the DMM.

Volunteer Recognition

East Portage Bay was monitored in 2010 by Bill Harvey, Marje Henke, Catherine LeBoeuf, **Joan McKinnon**,Wayne McKinnon, and **Lawton Osler**.

2010 Data

POR-0: TP-Spring turnover = 5.0 µg/L
TP-Yearly mean = 4.4 µg/L
Secchi = 4.8 m

POR-1: TP-Yearly mean = 3.9 µg/L

POR-2: TP-Yearly mean = 4.3 µg/L

POR-3: TP-Yearly mean = 6.1 µg/L

POR-4: TP-Yearly mean = 7.1 µg/L

POR-5: TP-Yearly mean = 9.4 µg/L*

* Yearly mean phosphorus at POR-5 was skewed due to three elevated measurements (11.9/18.8/20.4).

Total coliform and *E. coli* were not monitored in this sampling area.

Trends

Monitoring of East Portage Bay started in 2005. Since then, spring turnover and yearly mean phosphorus concentrations have fluctuated above the threshold value. Yearly mean phosphorus has trended downward over the period of 2008-2010.

Comments and/or Recommendations

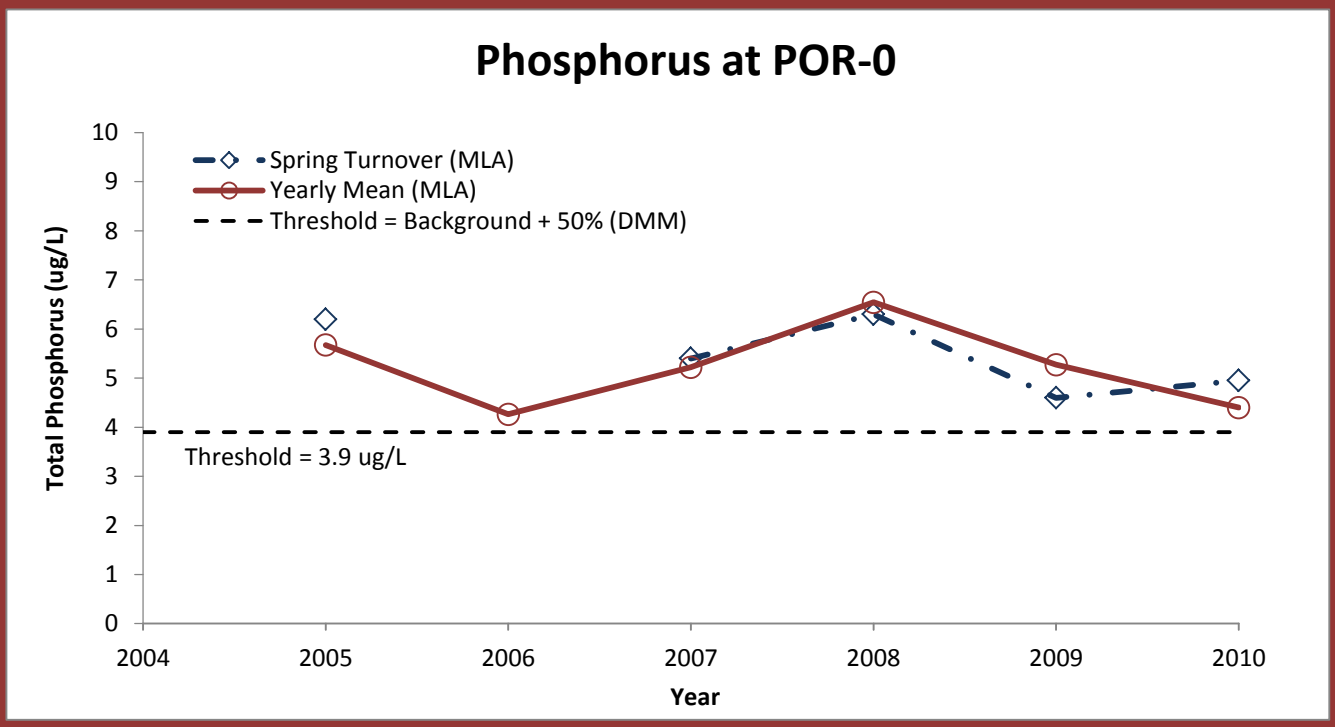
Nearshore sampling did not detect land-based influences on nearshore phosphorus.

Maintain the existing monitoring schedule until the DMM remodels East Portage Bay in 2011.

OBBN data from 2010 indicates that water quality is slightly better than the Muskoka average.

Nearshore sampling should be repeated using a filter in 2011 due to variability in nearshore phosphorus data.

(POR) EAST PORTAGE BAY



Notes:

LAKE ROSSEAU (ROS-1)

Area Description

The main basin of Lake Rosseau is approximately 55.5 km² in area with a maximum depth of 60 m. The lake is classified as a coldwater lake, and supports a naturally reproducing population of lake trout. Wetlands account for 5% of the upper watershed. The Lake Rosseau watershed, excluding the lake itself is 204.5 km². The DMM has classified the lake as moderately sensitive.

Volunteer Recognition

Lake Rosseau was monitored in 2010 by Peter Seybold.

2010 Data

ROS-1: TP-Spring turnover = 6.4 µg/L
Secchi = 3.5 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

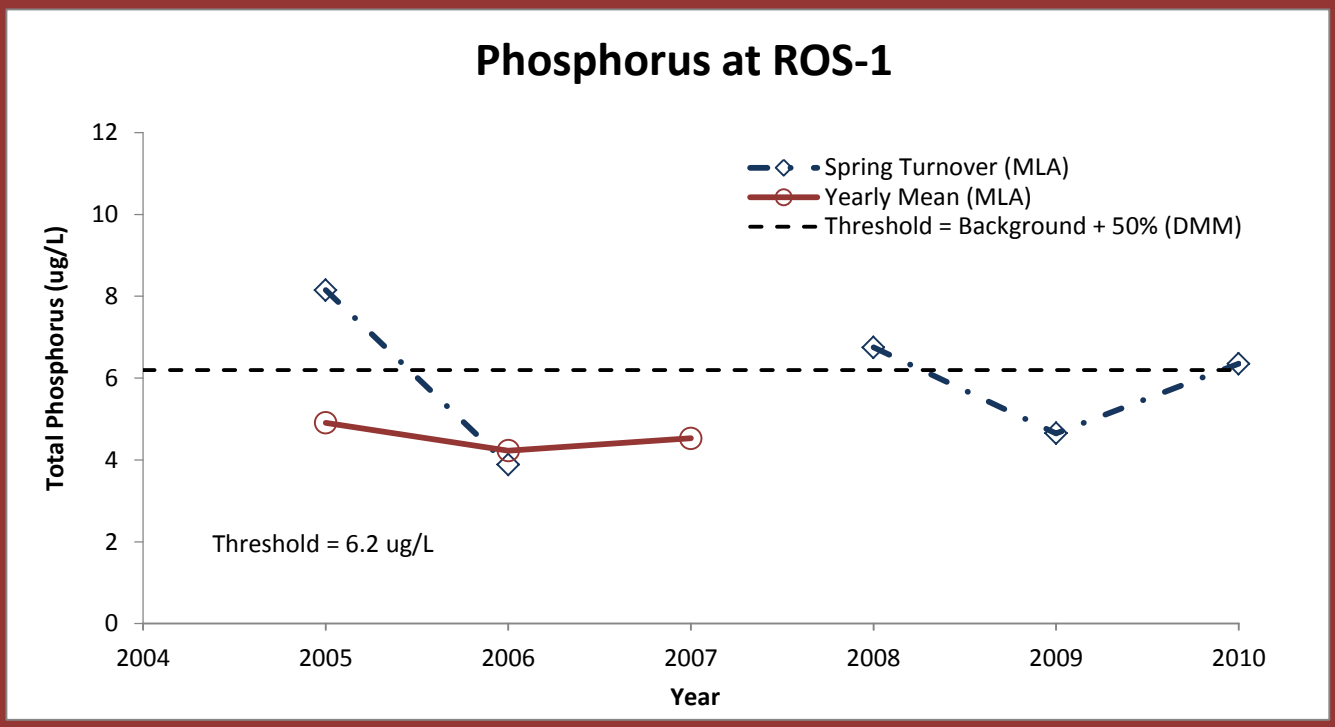
Monitoring of Lake Rosseau's main basin started in 2005. Spring turnover phosphorus concentrations have fluctuated near the threshold value.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

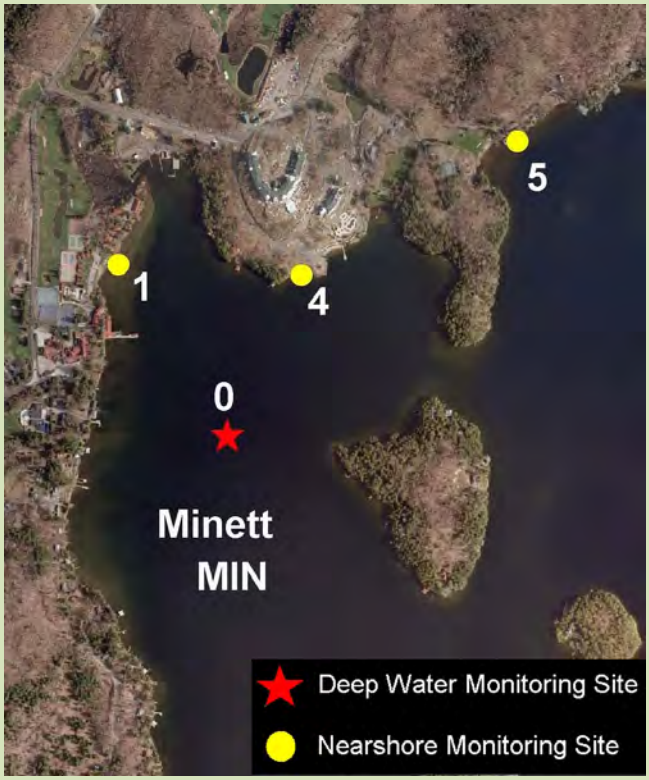
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(ROS-1) LAKE ROSSEAU



Notes:

MINETT (MIN)



Area Description

The village of Minett is located in western Lake Rosseau, and has four sampling sites. Sampling sites were selected with the intention of monitoring the potential effects of high intensity development in this bay. The area contains two large resorts with golf courses, several roads, a marina, and many private residential properties. There is one wetland adjacent to the lake and several other small ones in the area of the bay.

Volunteer Recognition

Minett was monitored in 2010 by **Greg Thomson**, **Laurie Thomson**, Noah Thomson, and Taylor Thomson.

2010 Data

MIN-0: TP-Spring turnover = 4.2 µg/L
TP-Yearly mean = 3.8 µg/L
Secchi = 4.1 m
Total coliforms = 27 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MIN-1: Total coliforms = 133 cfu/100 mL
Total *E. coli* = 27 cfu/100 mL

MIN-4: Total coliforms = 112 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

MIN-5: Total coliforms = 105 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

Trends

Monitoring of Minett started in 2003 and total phophorus concentrations have fluctuated since then. Both the spring turnover and yearly mean concentrations observed in 2010 were lower than in any previous year.

In 2010, *E. coli* levels were highest at MIN-1, which is consistent with data from previous years.

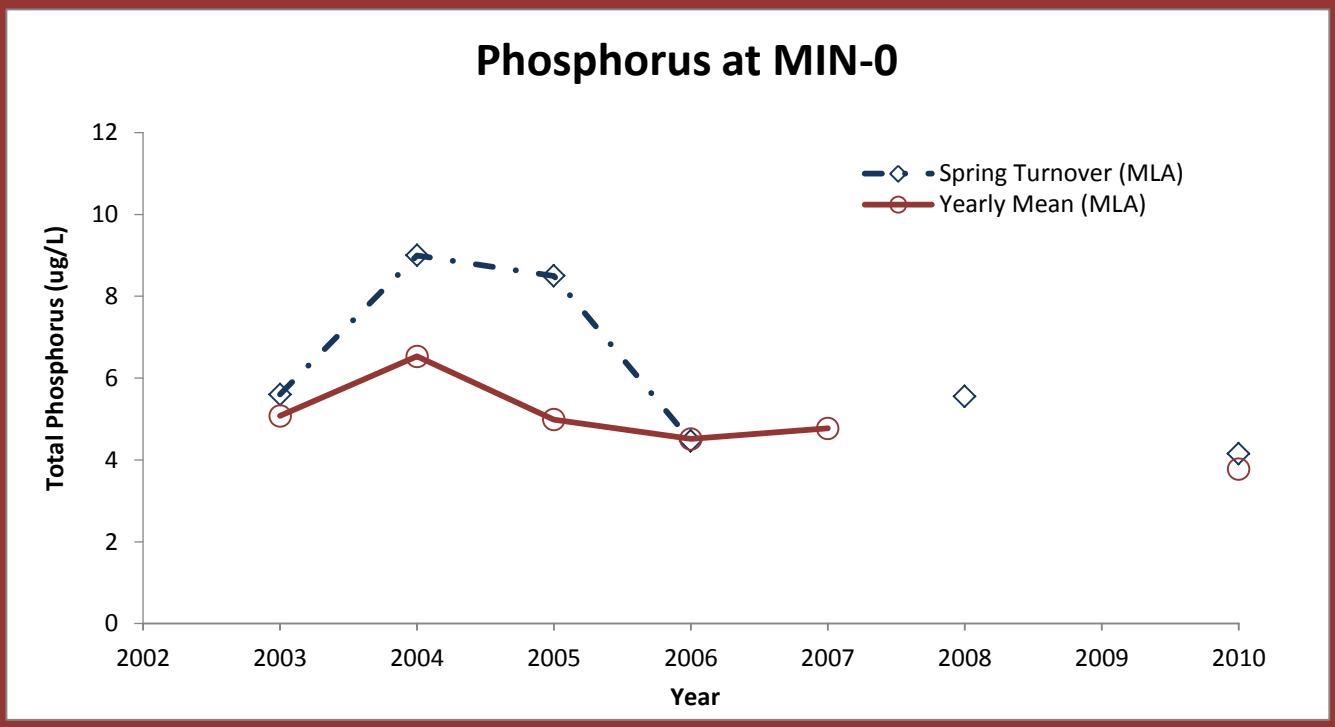
Comments and/or Recommendations

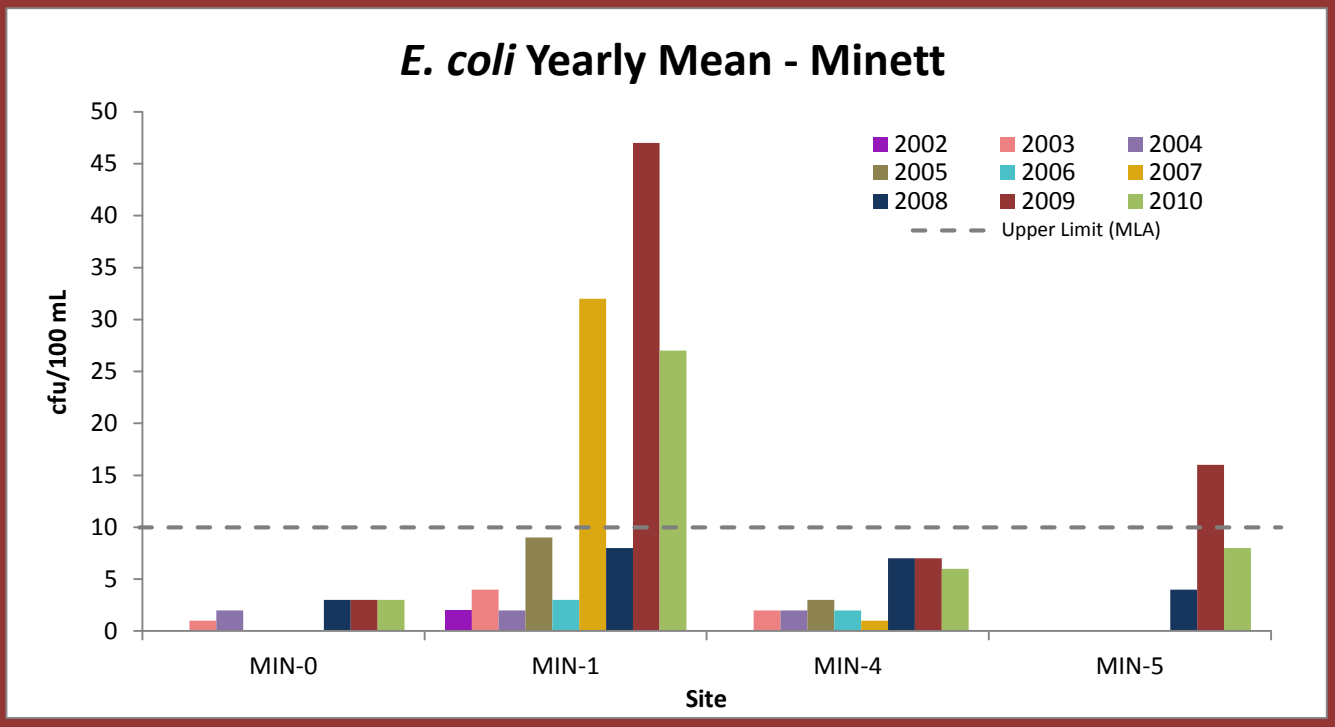
MIN-1 is located on the north side of the Cleveland's House dock. In 2011, continue monitoring bacteria at this site.

Consider adding another bacterial monitoring site at the north end of the bay close to the creek outlet.

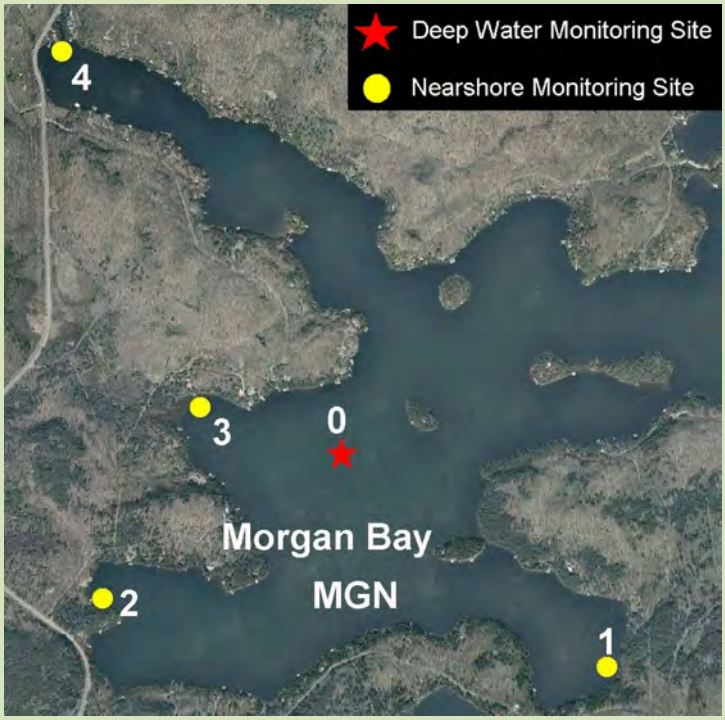
8 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at MIN-4.

(MIN) MINETT


Phosphorus at MIN-0
Total Phosphorus (ug/L)
0
2
4
6
8
10
12
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Spring Turnover (MLA)
Yearly Mean (MLA)


E. coli Yearly Mean - Minett
cfu/100 mL
0
5
10
15
20
25
30
35
40
45
50
MIN-0
MIN-1
MIN-4
MIN-5
Site
2002
2003
2004
2005
2006
2007
2008
2009
2010
Upper Limit (MLA)

MORGAN BAY (MGN)



Area Description

Morgan Bay is in the northernmost part of Lake Rosseau, and a series of small bays make up this large sampling area. Several creeks outlet into this bay close to the nearshore sampling sites and there is a wetland adjacent to the lake at MGN-3. Most of the shoreline area is developed with residential properties, but many retain natural riparian vegetation. Nearly the entire area has road access and several of these roadways come very close to the water; this is particularly evident at MGN-4.

Volunteer Recognition

Morgan Bay was monitored in 2010 by Peter Martin, Paul Mitcham, **David Peacock**, Devon Peacock, Mary Anne Peacock, and Karis Van Essen.

2010 Data

MGN-0: TP-Spring turnover = 5.6 µg/L
TP-Yearly mean = 4.4 µg/L
Secchi = 3.8 m
Total coliforms = 3 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MGN-1: TP-Yearly mean = 5.0 µg/L
Total coliforms = 13 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MGN-2: TP-Yearly mean = 4.3 µg/L
Total coliforms = 16 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MGN-3: TP-Yearly mean = 6.6 µg/L
Total coliforms = 45 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MGN-4: TP-Yearly mean = 5.7 µg/L
Total coliforms = 51 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

Monitoring of Morgan Bay started in 2008.

2010 *E. coli* levels were higher than 2009 levels at MGN-2 and MGN-3.

*2009 spring turnover phosphorus duplicate outlier removed (3.8/27.3).

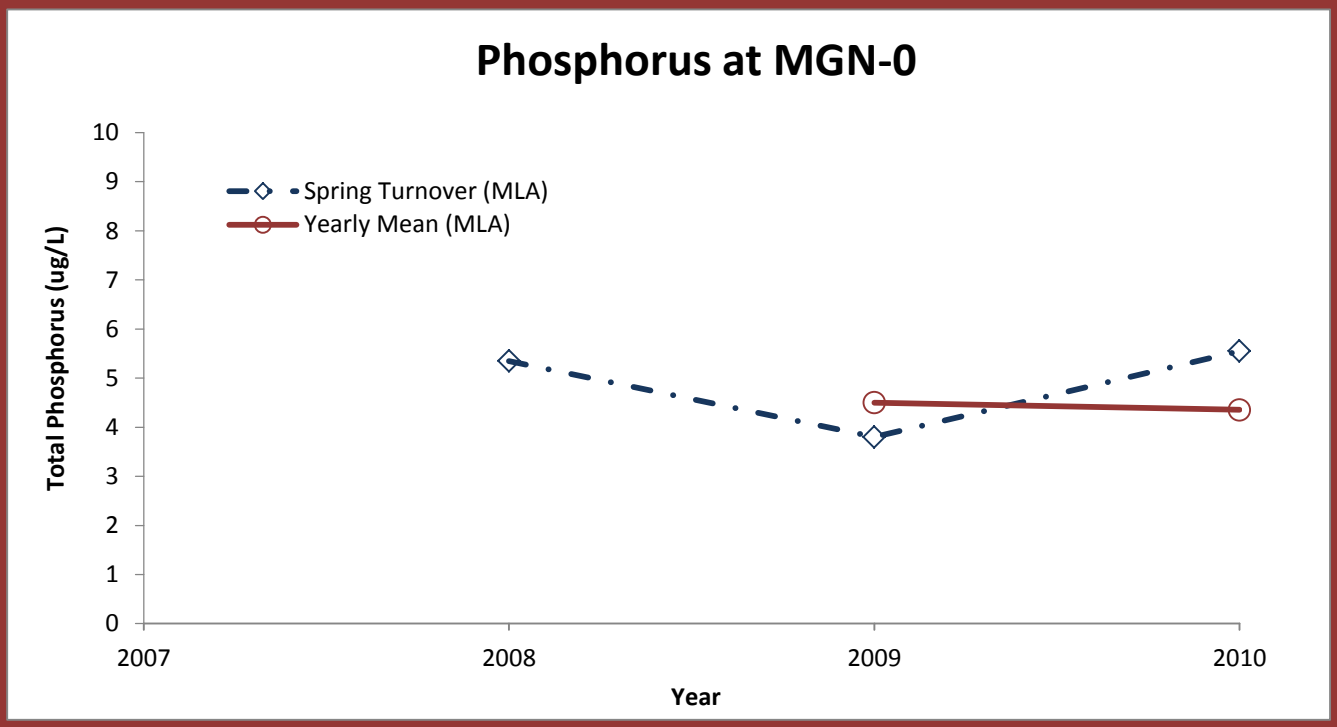
Comments and/or Recommendations

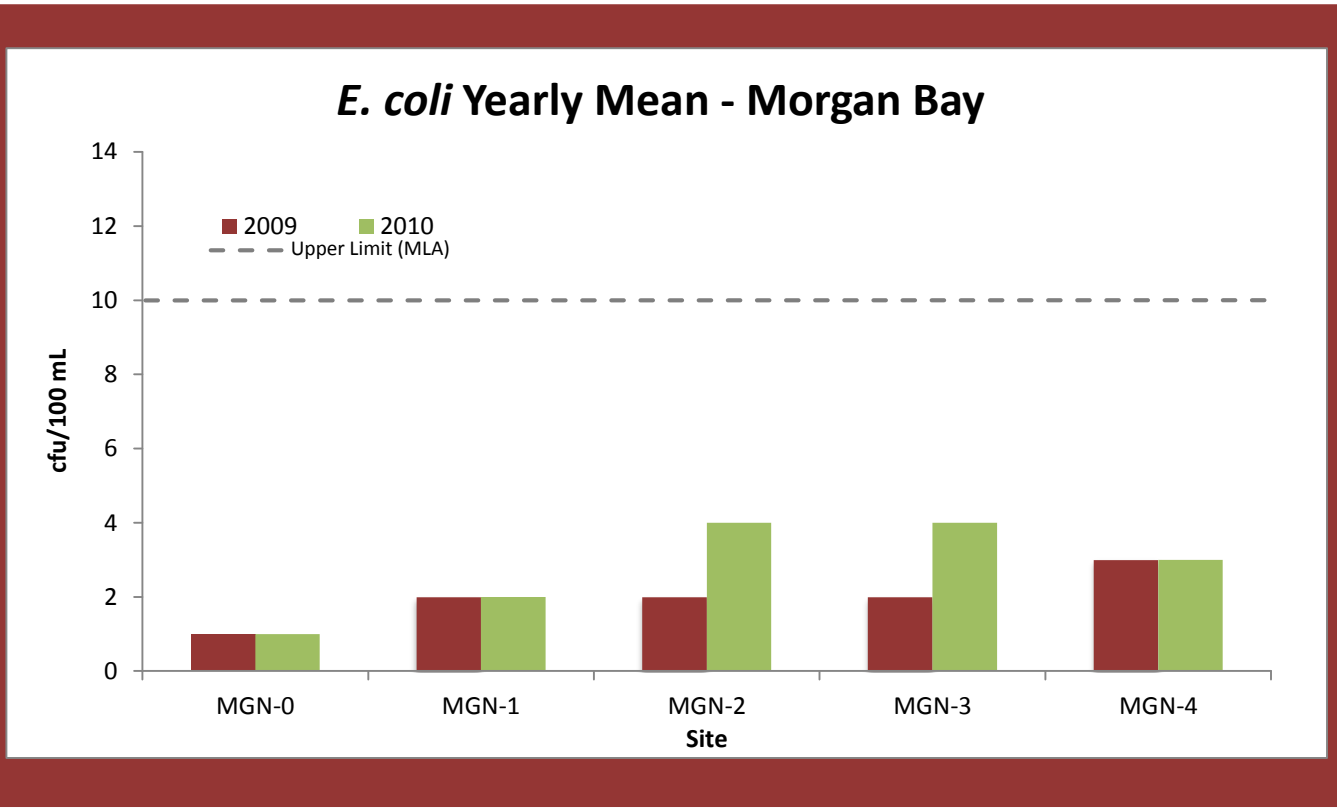
Nearshore sampling at MGN-3 suggests potential land-based influences on nearshore phosphorus.

In 2011, continue monitoring nearshore phosphorus at MGN-3 and document adjacent land use.

Make notes on the proximity of MGN-3 to the wetland and creek outlet.

(MGN) MORGAN BAY





MUSKOKA LAKES G&CC (MLG)

Area Description

The Muskoka Lakes Golf & Country Club sampling site is located along the southern shore of Lake Rosseau's main basin, near the Town of Port Carling. This bay collects run-off from a golf course area with associated clubhouse and marina. The bay also contains a large wetland that drains into the lake. Dominant northwest winds and a large fetch results in considerable wave action along the southern shoreline of the bay.

Volunteer Recognition

Muskoka Lakes Golf & Country Club was monitored in 2010 by Peter Seybold.

2010 Data

MLG-0: TP-Spring turnover = 3.4 µg/L
Secchi = 3.5 m

* Only spring turnover phoshporus was monitored in this sampling area.

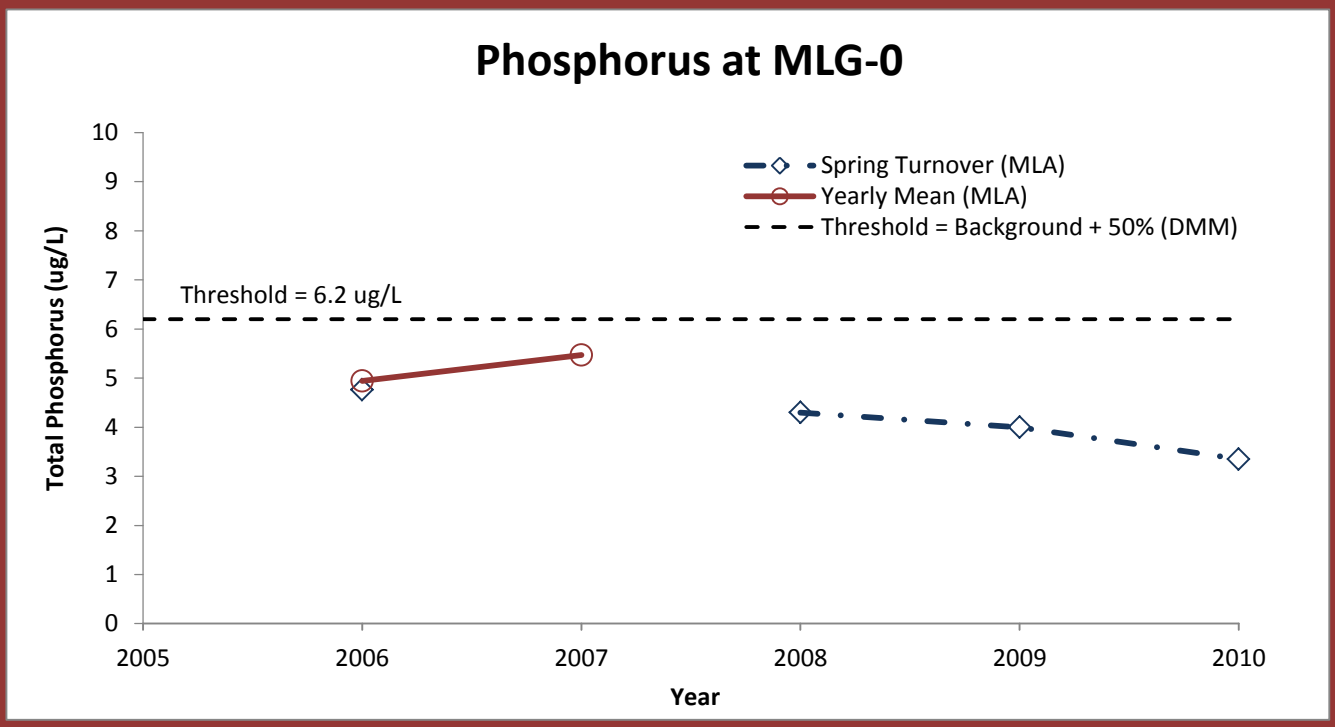
Trends

Monitoring of Muskoka Lakes Golf and Country Club started in 2006.

Since 2008, spring turnover phosphorus concentrations have trended downward, remaining below the threshold value.

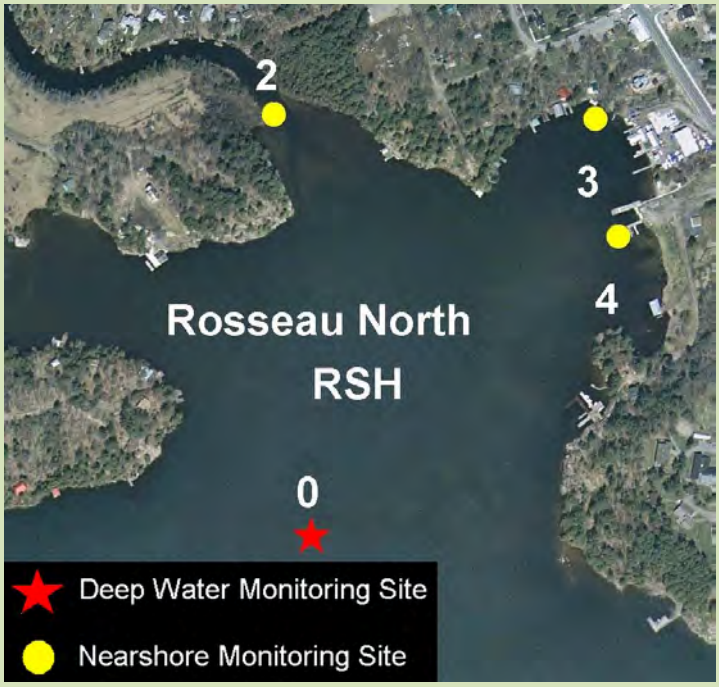
Comments and/or Recommendations

Continue sampling spring turnover phosphorus annually to monitor long-term trends.


Phosphorus at MLG-0
Total Phosphorus (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Threshold = 6.2 ug/L
Spring Turnover (MLA)
Yearly Mean (MLA)
Threshold = Background + 50% (DMM)
2005
2006
2007
2008
2009
2010
Year

Notes:

ROSSEAU NORTH (RSH)



Area Description

The Rosseau North sampling area is within the limits of the village of Rosseau, at the northern end of Lake Rosseau. Drainage from the village enters the lake at the sampling sites, as well as at the mouth of the Shadow River. Two creeks drain into the bay, one through a lacustrine wetland along the western shoreline and the other near Highway 141 to the east. There is a high level of development not only along the shoreline of the lake and Shadow River, but in much of the watershed area in the form of residential and agricultural properties.

Volunteer Recognition

Rosseau North was monitored in 2010 by Peter Martin, Paul Mitcham, **David Peacock**, Devon & Mary Anne Peacock, and Karis Van Essen.

2010 Data

RSH-0: TP-Spring turnover = 5.3 µg/L
TP-Yearly mean = 4.6 µg/L
Secchi = 3.4 m
Total coliforms = 9 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

RSH-2: TP-Yearly mean = 8.7 µg/L
Total coliforms = 22 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

RSH-3: TP-Yearly mean = 6.4 µg/L
Total coliforms = 44 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

RSH-4: TP-Yearly mean = 5.5 µg/L
Total coliforms = 40 cfu/100 mL
Total *E. coli* = 13 cfu/100 mL

Trends

Monitoring of Rosseau North started in 2002. Total phophorus measurements have been highly variable at RSH-0. Spring turnover and yearly mean phosphorus concentrations have fluctuated since 2002, however they have trended downward over the period of 2008-2010. In 2010, *E. coli* levels at RSH-4 were elevated, falling above the MLA upper limit.

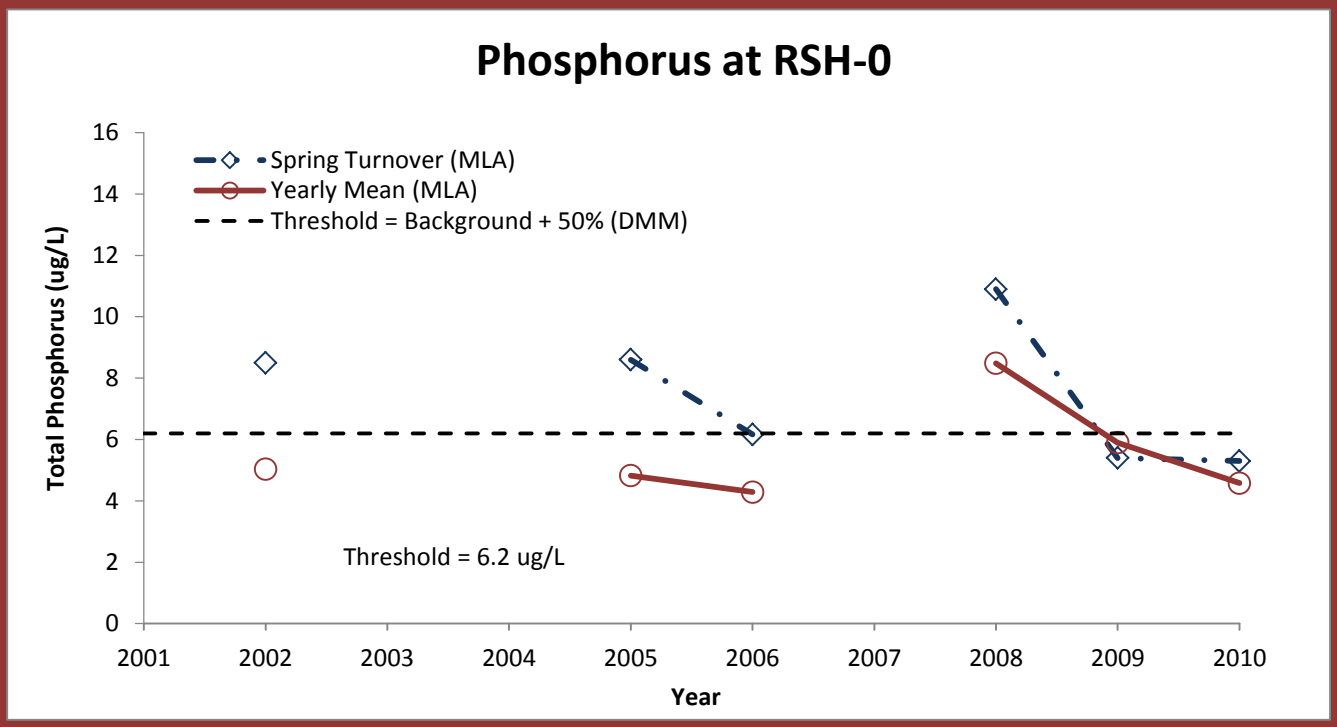
*2009 spring turnover phosphorus duplicate outlier removed (5.4/25.6)

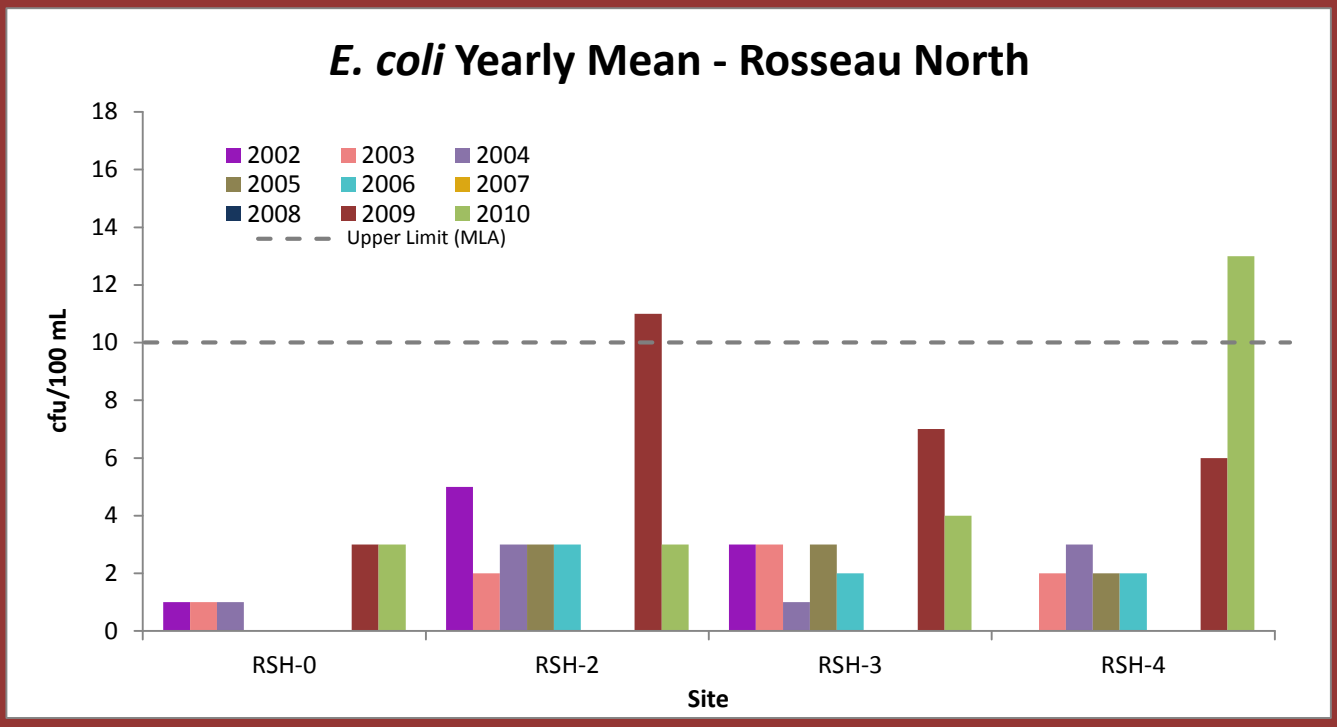
Comments and/or Recommendations

Nearshore sampling at RSH-2 suggests potential land-based influences on nearshore phosphorus. This is likely the result of sampling within the Shadow River. Additional upstream sampling would confirm the river influence.

Detailed land use descriptions should be collected at RSH-4 during the 2011 sampling season.

(RSH) ROSSEAU NORTH





ROYAL MUSKOKA ISLAND (RMI)

Area Description

Royal Muskoka Island has one deepwater sampling site located in the central portion of Lake Rosseau. This is a highly developed residential island with many roads and cottages along the shoreline. A large proportion of the interior of the island is cleared or otherwise altered. The eastern shore, opposite RMI-0, is less developed with residences spread out along the shore. Northwest winds and a long fetch would result in significant wave action.

Volunteer Recognition

Royal Muskoka Island was monitored in 2010 by Peter Seybold.

2010 Data

RMI-0: TP-Spring turnover = 7.0 µg/L
Secchi = 3.6 m

* Only spring turnover phoshporus was monitored in this sampling area .

Trends

Monitoring of Royal Muskoka Island started in 2003.

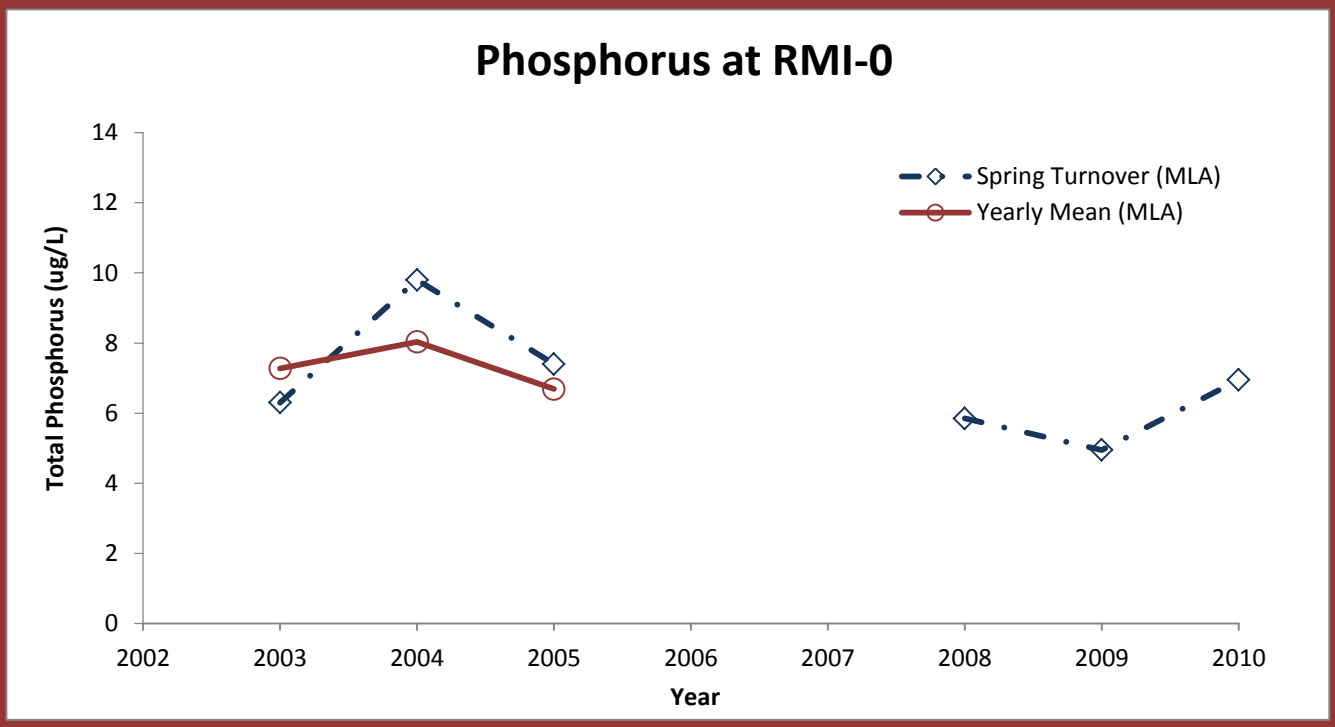
Spring turnover phosphorus concentrations have fluctuated over the two 3-year periods for which data was collected.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

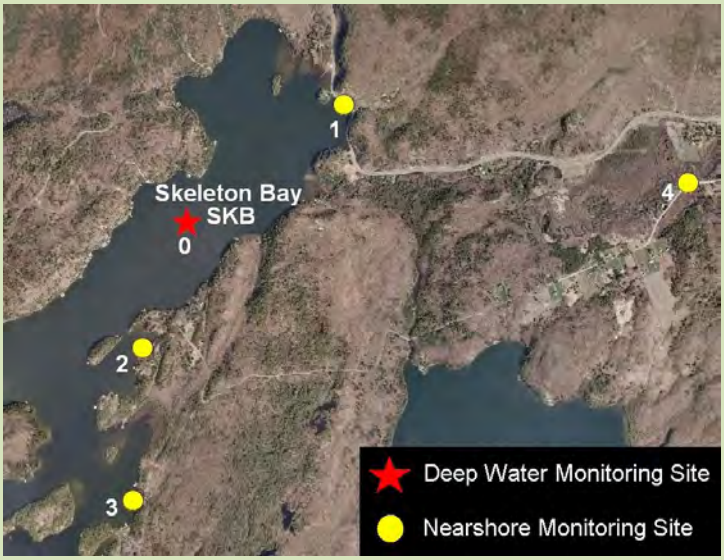
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(RMI) ROYAL MUSKOKA ISLAND



Notes:

SKELETON BAY (SKB)



Area Description

Skeleton Bay is located in the eastern portion of Lake Rosseau's north basin. It is approximately 1.7 km² in size with a maximum depth of 20 m. Hwy 141 follows the shoreline in the northeast section of the bay, below a steep cliffed area. This bay is fed by six watercourses including the Bent River which drains agricultural lands. Skeleton Bay is classified as moderately sensitive by the DMM.

Volunteer Recognition

Skeleton Bay was monitored in 2010 by James Lacombe and **David Peacock**.

2010 Data

SKB-0: TP-Spring turnover = 3.8 µg/L
TP-Yearly mean = 4.1 µg/L
Secchi = 4.1 m
Total coliforms = 23 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SKB-1: TP-Yearly mean = 5.5 µg/L
Total coliforms = 23 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SKB-3: TP-Yearly mean = 6.2 µg/L
Total coliforms = 56 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

SKB-4: TP-Yearly mean = 8.5 µg/L
Total coliforms = 54 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

Trends

Monitoring of Skeleton Bay started in 2010. Spring turnover and yearly mean phosphorus concentrations were below the threshold value.

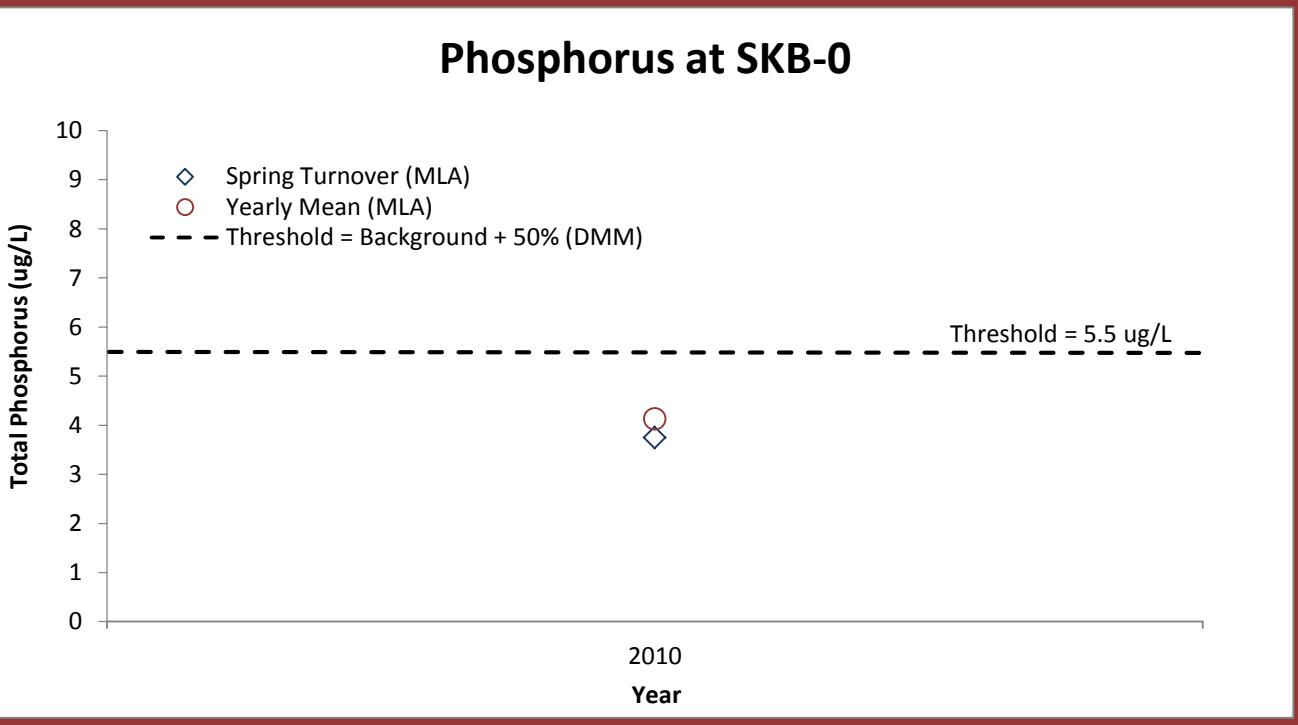
In 2010, *E. coli* levels were below the MLA upper limit at all four sampling sites. Higher levels of bacteria and phosphorus were observed at SKB-4.

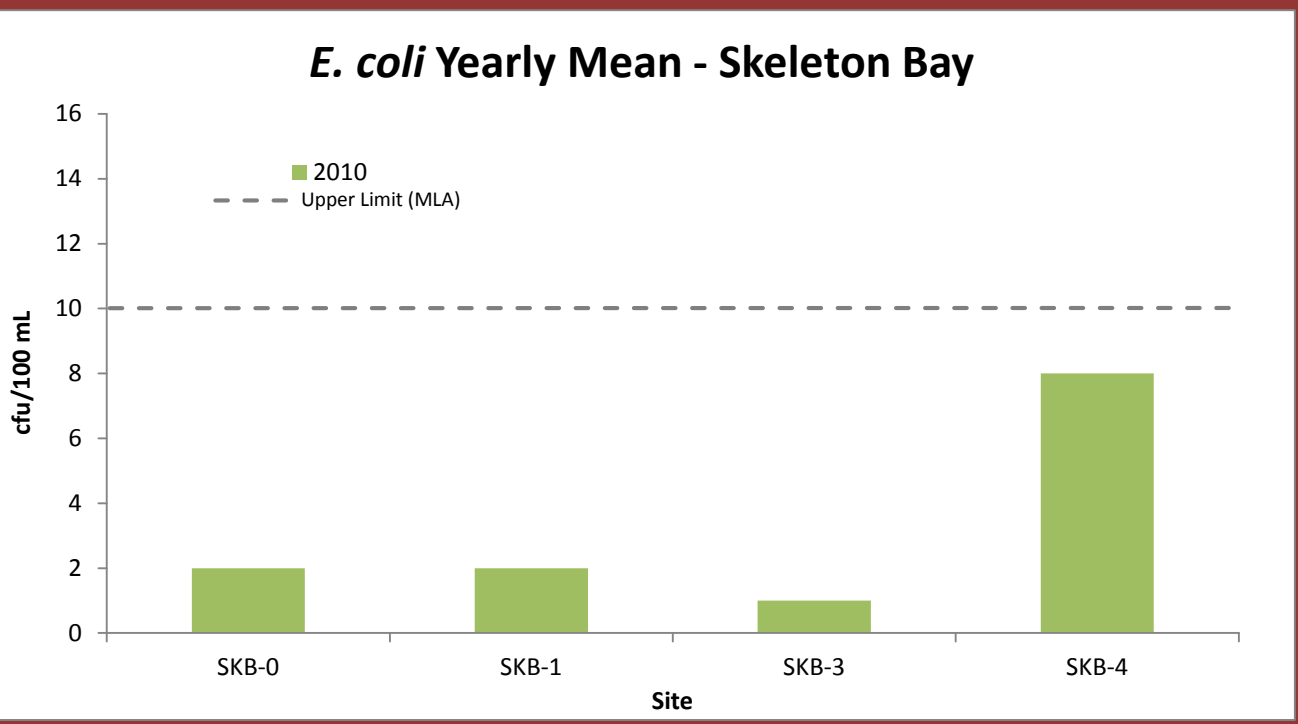
Comments and/or Recommendations

Nearshore sampling at SKB-4 detected land-based influences on nearshore phosphorus.

SKB-4 is located within the Bent River, therefore we would expect phosphorus and *E. coli* levels to be higher than those found in the lake.

(SKB) SKELETON BAY





TOBIN'S ISLAND (TOB)

Area Description

Tobin's Island is an open bay area in the central part of Lake Rosseau. The surrounding area is moderately developed with cottage/residential properties along the shoreline and much of the inland forest area remaining in a natural state. Two creeks from adjacent wetland areas drain into the lake within this sampling area.

Volunteer Recognition

Tobin's Island was monitored in 2010 by Peter Seybold.

2010 Data

TOB-0: TP-Spring turnover = 7.8 µg/L
Secchi = 3.5 m

* Only spring turnover phoshporus was monitored in this sampling area.

Trends

Monitoring of Tobin's Island started in 2006.

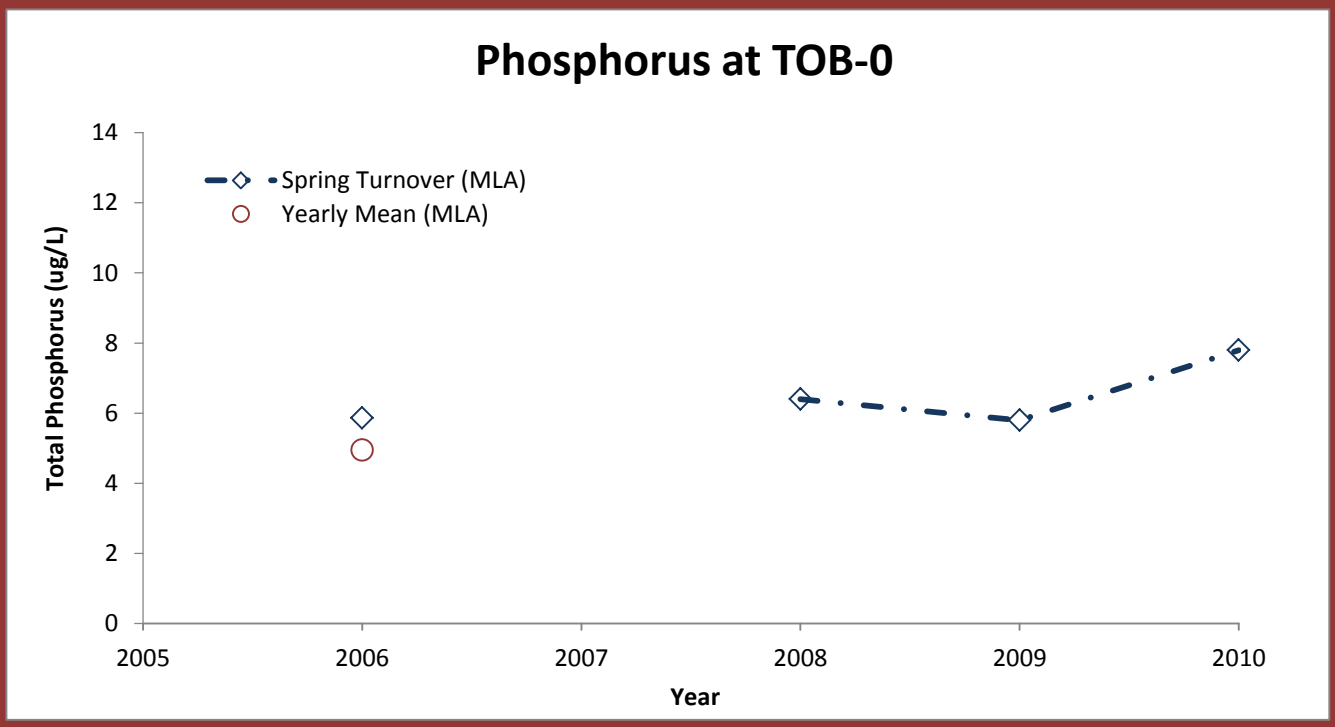
Spring turnover phosphorus concentrations have fluctuated over the period of 2008-2010.

Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

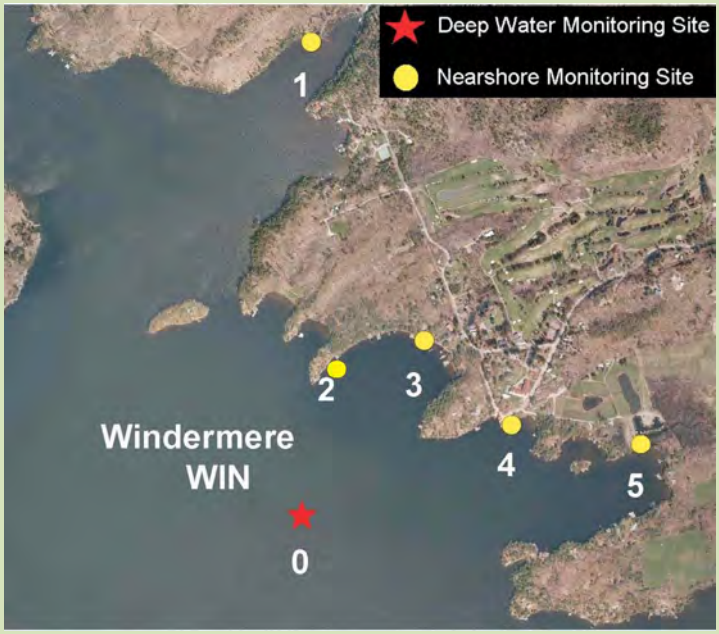
Continue sampling spring turnover phosphorus annually to monitor long-term trends.

(TOB) TOBIN'S ISLAND



Notes:

WINDERMERE (WIN)



Area Description

The Windermere village area in northern Lake Rosseau is a highly developed resort and residential area. There is a large resort complex, golf course, marina, and many residential properties. In addition, there is a significant amount of agricultural land near the sampling area. Several creeks outlet into this area, one of which flows through farms fields and wetlands and enters the lake at the marina. WIN-1 is located away from the village in a primarily natural area at the outlet of the Dee River and Clark Pond.

Volunteer Recognition

Windermere was monitored in 2010 by **Rebecca Francis**, Lisa Noonan, Cameron Purdy, Drew Purdy, Katherine Seybold, and Peter Seybold.

2010 Data

WIN-0: TP-Spring turnover = 7.3 µg/L
TP-Yearly mean = 4.5 ug/L
Secchi = 4.2 m
Total coliforms = 4 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

WIN-1: TP-Yearly mean = 12.1 µg/L
Total coliforms = 47 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

WIN-2: TP-Yearly mean = 8.3 µg/L
Total coliforms = 28 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

WIN-3: TP-Yearly mean = 4.3 µg/L
Total coliforms = 18 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

WIN-4: TP-Yearly mean = 5.5 µg/L
Total coliforms = 46 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

WIN-5: TP-Yearly mean = 9.8 µg/L
Total coliforms = 79 cfu/100 mL
Total *E. coli* = 24 cfu/100 mL

Trends

Monitoring of Windermere started in 2003. Since then, both spring turnover and yearly mean phosphorus concentrations have fluctuated.

In 2010, bacteria levels at WIN-5 were elevated relative to other sites in the area, with *E. coli* being above the MLA upper limit.

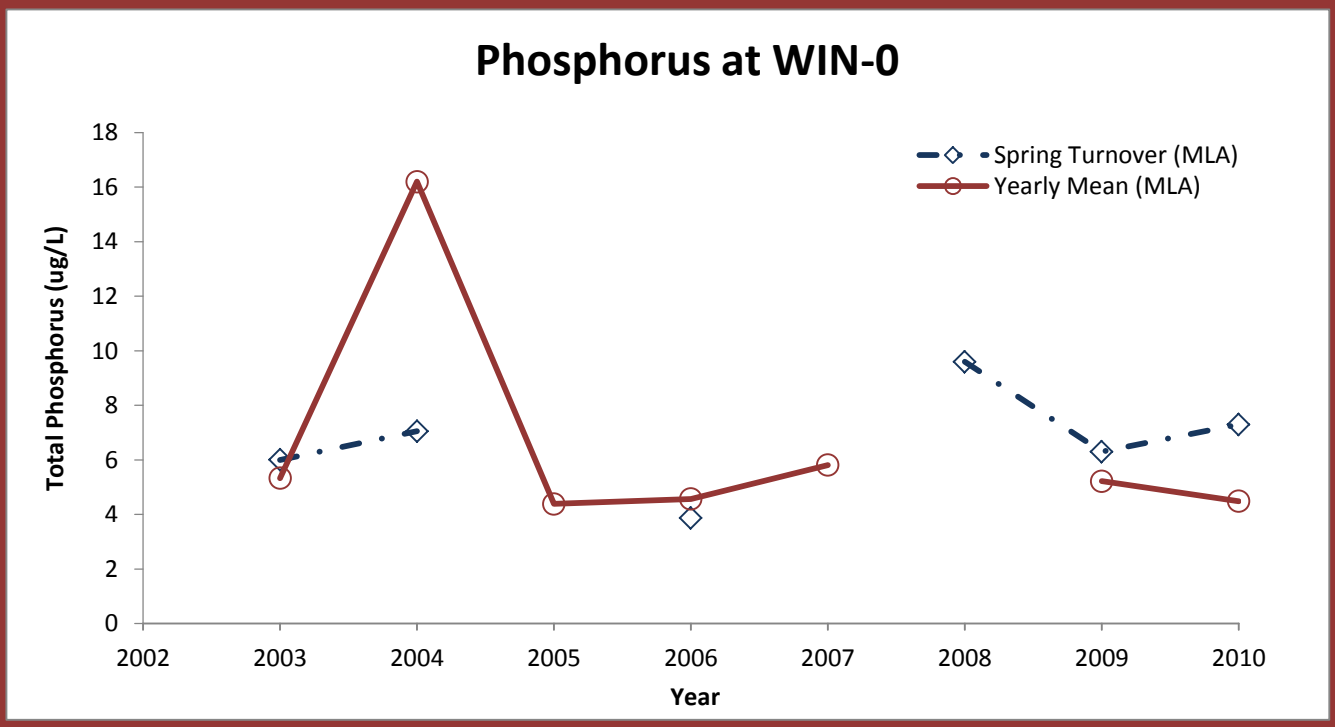
High bacteria counts recorded at WIN-3 in 2009 were not observed in 2010.

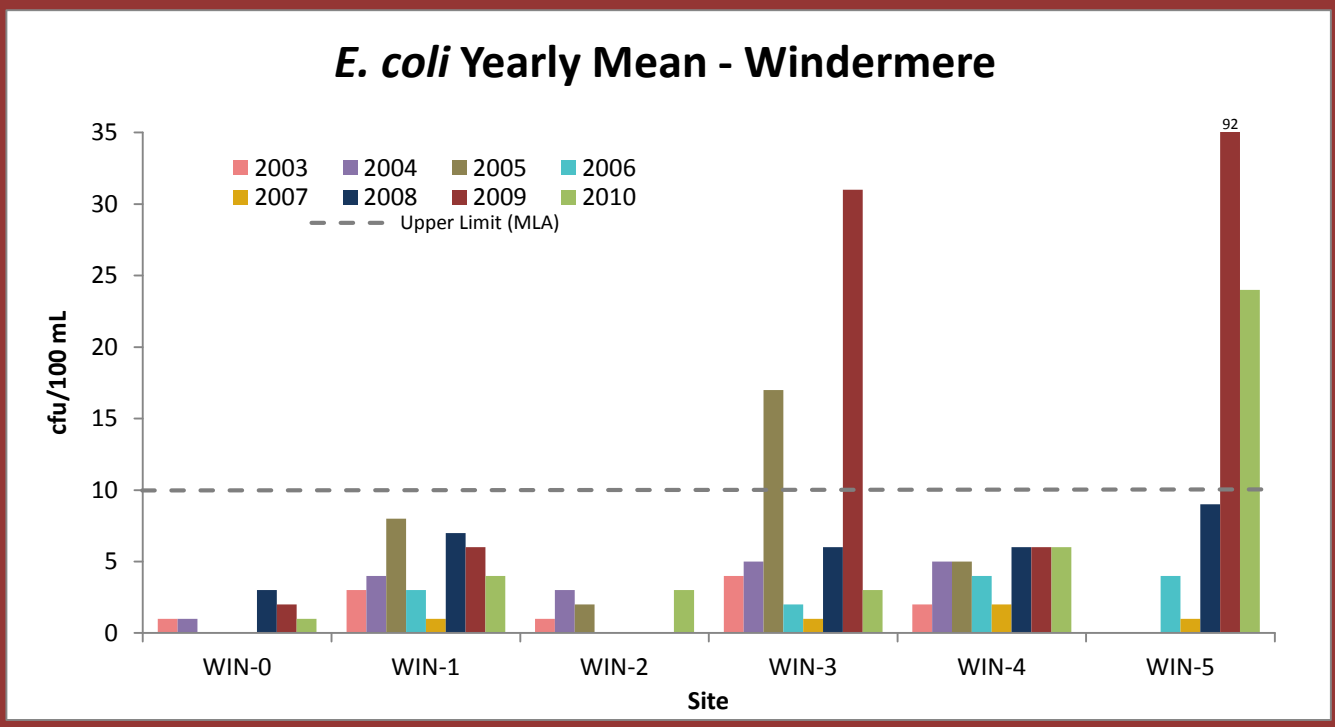
Comments and/or Recommendations

Nearshore sampling at WIN-1 and WIN-5 suggests potential land-based influences on nearshore phosphorus.

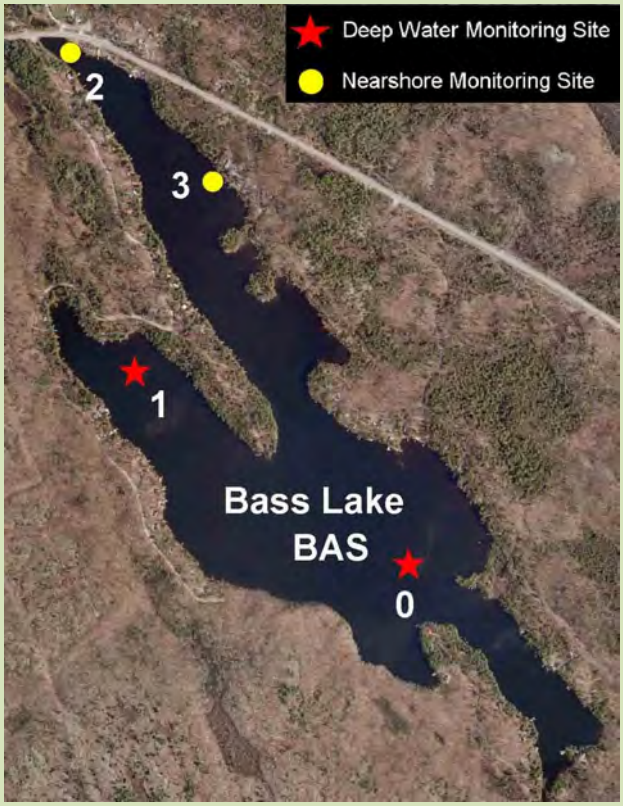
Elevated levels of phosphorus and *E. coli* at WIN -5 warrant further investigation of land use and creek influence in 2011.

(WIN) WINDERMERE





BASS LAKE (BAS)



Area Description

Bass Lake is a small, shallow, moderately developed lake located immediately southwest of Lake Joseph. It is 0.96 km^2 in area with a maximum depth of 8 m. Hwy 169 separates this lake from Lake Joseph at the north end. Bass Lake drains wetlands located to the south and water flows into Stills Bay via Stills Falls. Bass Lake has been classified as moderately sensitive by the DMM.

Volunteer Recognition

Bass Lake was monitored in 2010 by **Chris Bodanis**, Bev Turney and Chris Turney.

2010 Data

BAS-0: TP-Yearly mean = 7.5 µg/L
Secchi = 2.8 m

BAS-1: TP-Spring turnover = 7.3 µg/L
TP-Yearly mean = 6.7 µg/L
Secchi = 2.9 m

BAS-2: Total coliforms = 103 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BAS-3: Total coliforms = 33 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Bass Lake was monitored from 2005 to 2007 and again in 2010. Both the spring turnover and yearly mean phosphorus levels were below the threshold value in 2010.

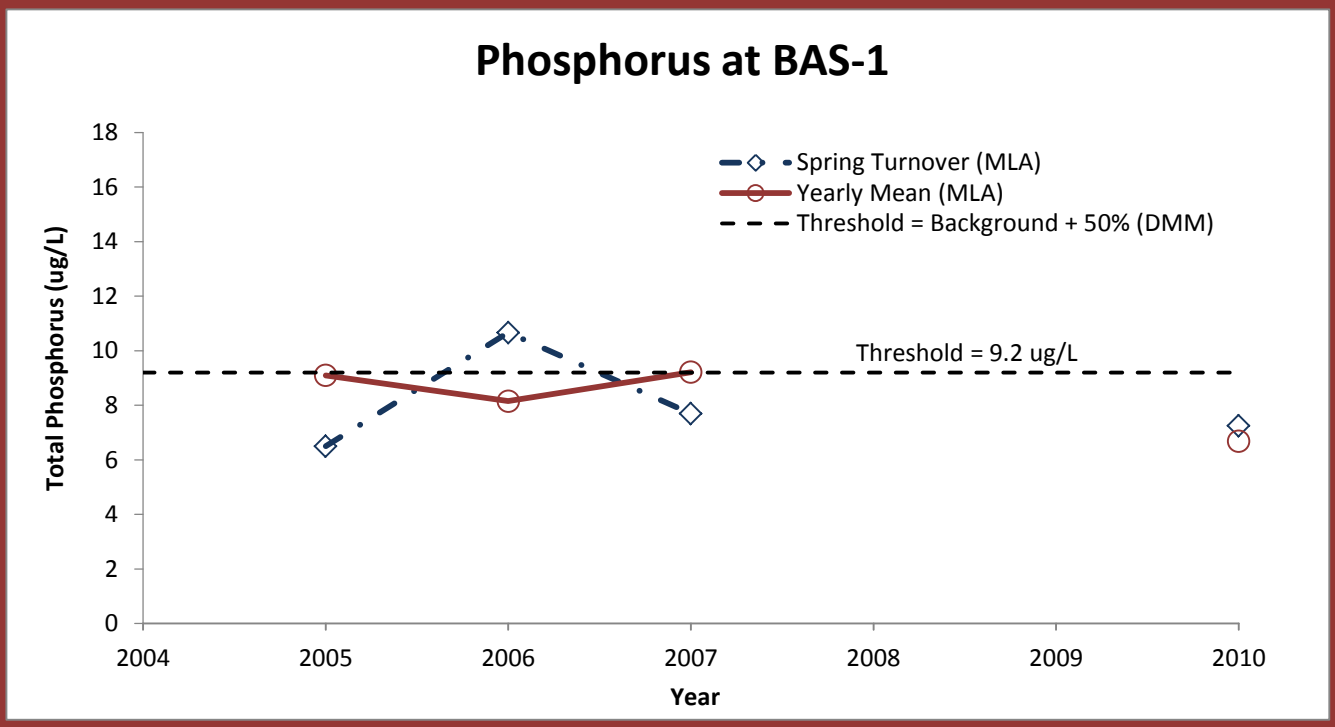
In 2010, *E. coli* levels at BAS-2 and BAS-3 were similar to those observed in 2005 and 2006.

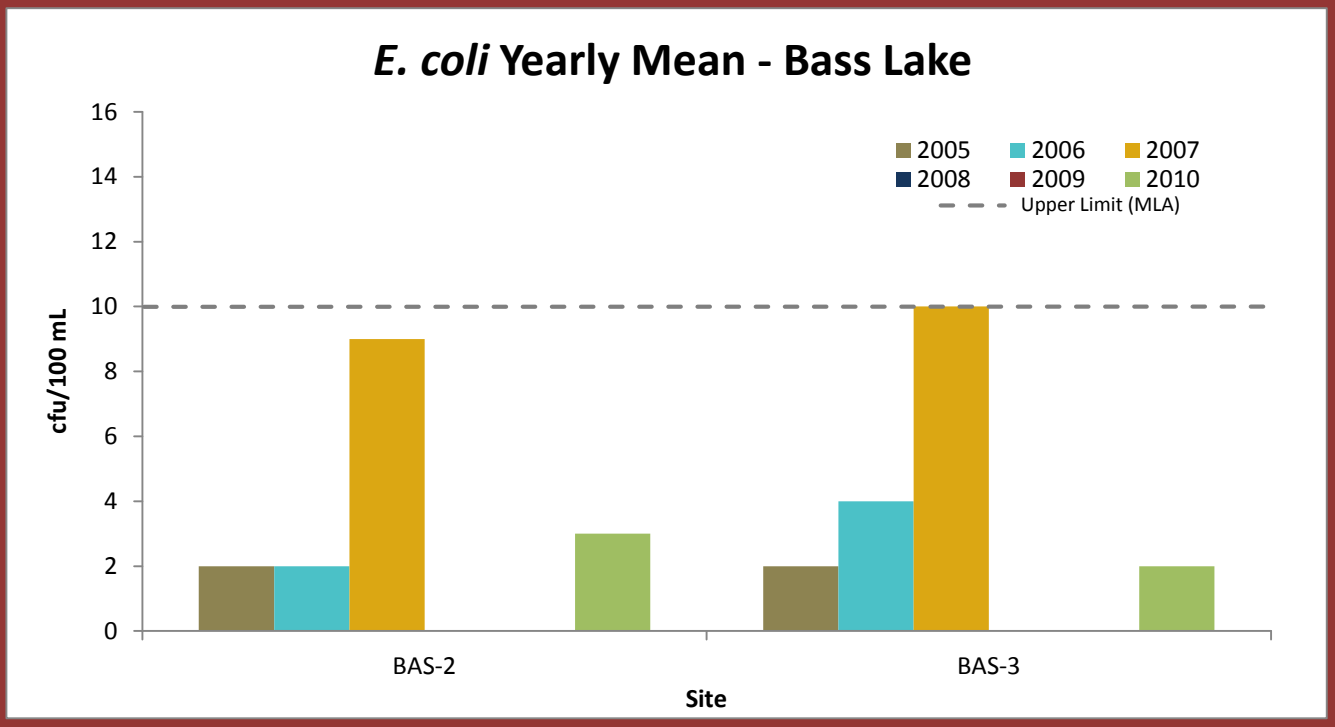
Comments and/or Recommendations

Additional spring turnover phosphorus data is required to determine long-term trends.

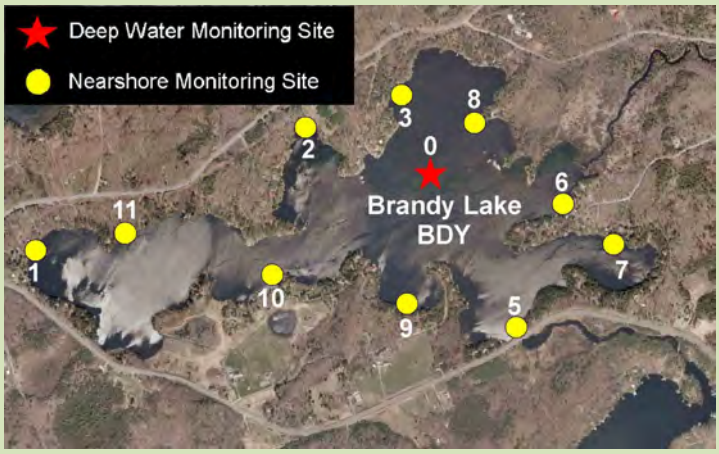
Select one deepwater reference location for long-term monitoring of spring turnover phosphorus.

(BAS) BASS LAKE





BRANDY LAKE (BDY)



Area Description

The shoreline of Brandy Lake is moderately developed with many residences and access roads. A large number of the properties maintain a natural shoreline but, there is close to 10% un-buffered lawn. Approximately 40% of the lake shoreline is natural wetland. In the eastern portion of the lake, there is a large wetland with a creek outlet. A second creek is located to the southeast. Brandy Lake is a dystrophic, or "tea-coloured" lake, which is naturally rich in carbon.

Volunteer Recognition

Brandy Lake was monitored in 2010 by Barbara Fraser, Bob Hogg, Lorna Hogg, Tony Mathia, **Donna Sale**, **Peter Sale** and Gary Staley.

2010 Data

BDY-0: TP-Spring turnover = 16.6 µg/L
Secchi = 1.1 m

BDY-1: Total coliforms = 89 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BDY-2: Total coliforms = 106 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BDY-3: Total coliforms = 105 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

BDY-5: Total coliforms = 66 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BDY-6: Total coliforms = 87 cfu/100 mL
Total *E. coli* = 9 cfu/100 mL

BDY-7: Total coliforms = 76 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

BDY-8: Total coliforms = 116 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

BDY-9: Total coliforms = 42 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

BDY-10: Total coliforms = 106 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BDY-11: Total coliforms = 114 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

Trends

Monitoring of Brandy Lake started in 2004.

Spring turnover phosphorus has trended downward since 2005.

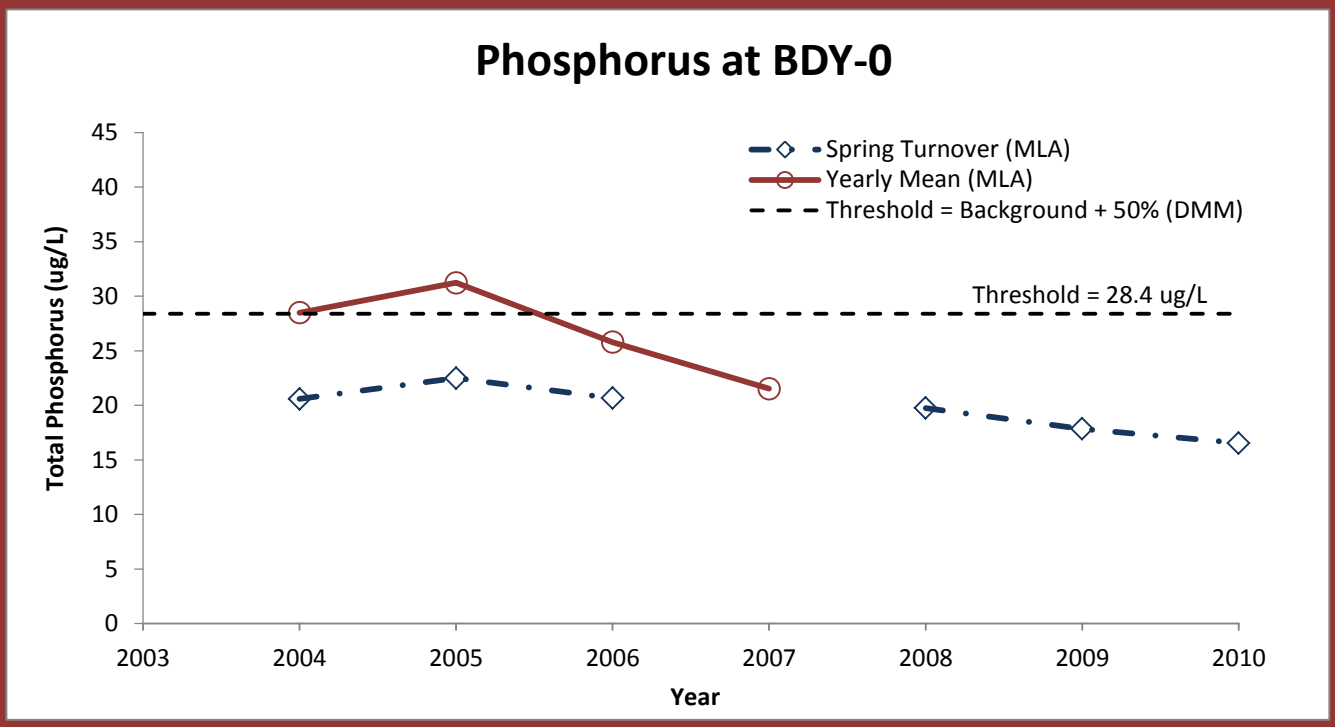
In 2010, *E. coli* levels ranged from 2-9 cfu/100mL, below the MLA upper limit.

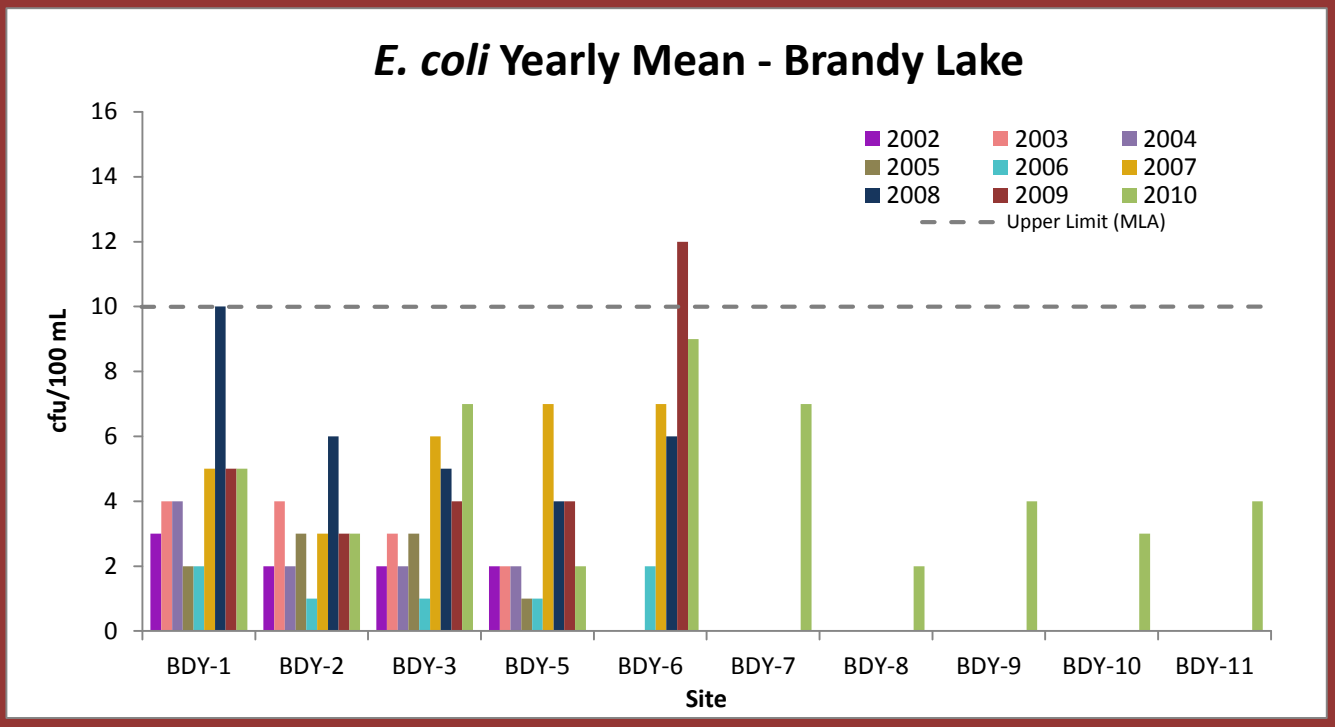
Comments and/or Recommendations

Brandy Lake is naturally mesotrophic and spring turnover phosphorus levels are within the expected range.

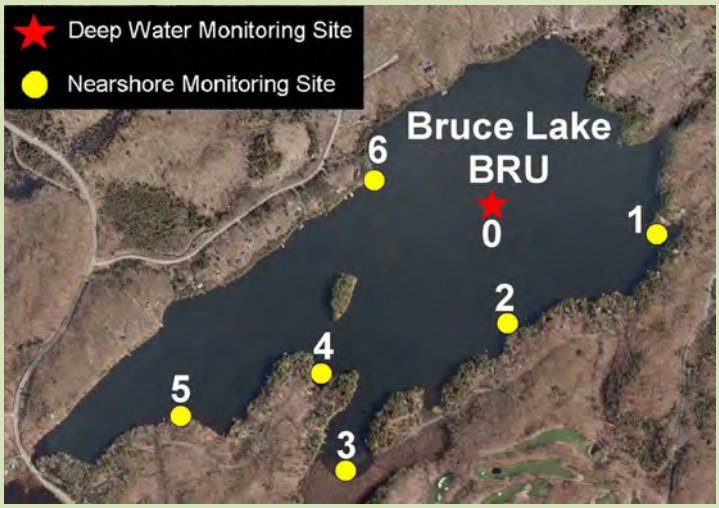
9 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at BDY-1, 2, and 5 and establishing new sampling sites.

(BDY) BRANDY LAKE





BRUCE LAKE (BRU)



Area Description

Bruce Lake is located east of Hwy 632, between Lake Joseph and Lake Rosseau. It is relatively small in size at 1.0 km^2 and has a maximum depth of 6 m. Approximately 25% of the catchment area for this lake is made up of wetlands. The lake is moderately developed and there is a golf course located immediately to the south. Bruce Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Bruce Lake was monitored in 2010 by Cindy Hutchinson, **Paul Hutchinson**, Pat Ivanyshyn, Milan Kovac, Hugh McVittie, and Karen Weber.

2010 Data

BRU-0: TP-Spring turnover = 7.5 µg/L
TP-Yearly mean = 8.2 µg/L
Secchi = 3.5 m
Total coliforms = 13 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

BRU-1: TP-Yearly mean = 9.8 µg/L
Total coliforms = 46 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

BRU-3: TP-Yearly mean = 9.7 µg/L
Total coliforms = 44 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BRU-4: TP-Yearly mean = 8.6 µg/L
Total coliforms = 24 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

BRU-5: TP-Yearly mean = 8.8 µg/L
Total coliforms = 46 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

BRU-6: TP-Yearly mean = 8.6 µg/L
Total coliforms = 21 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

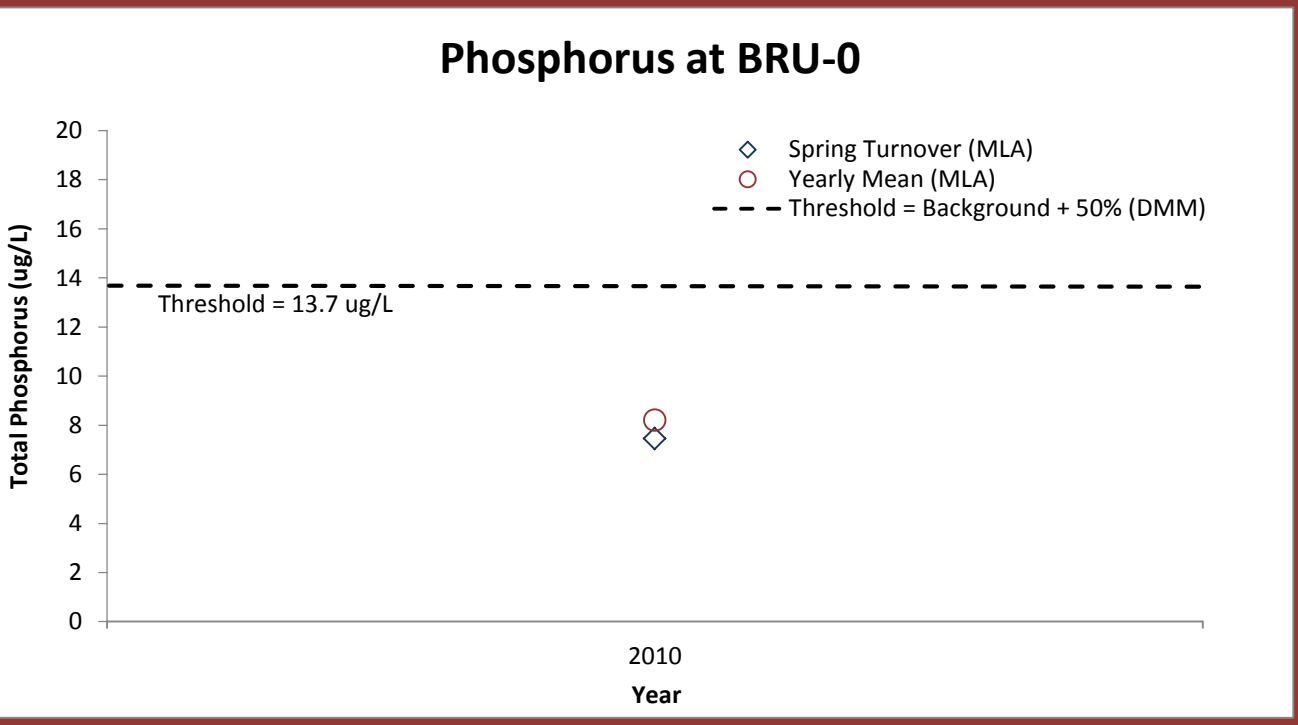
Monitoring of Bruce Lake started in 2010. Both the spring turnover and yearly mean phosphorus measurements for 2010 were below the threshold value.

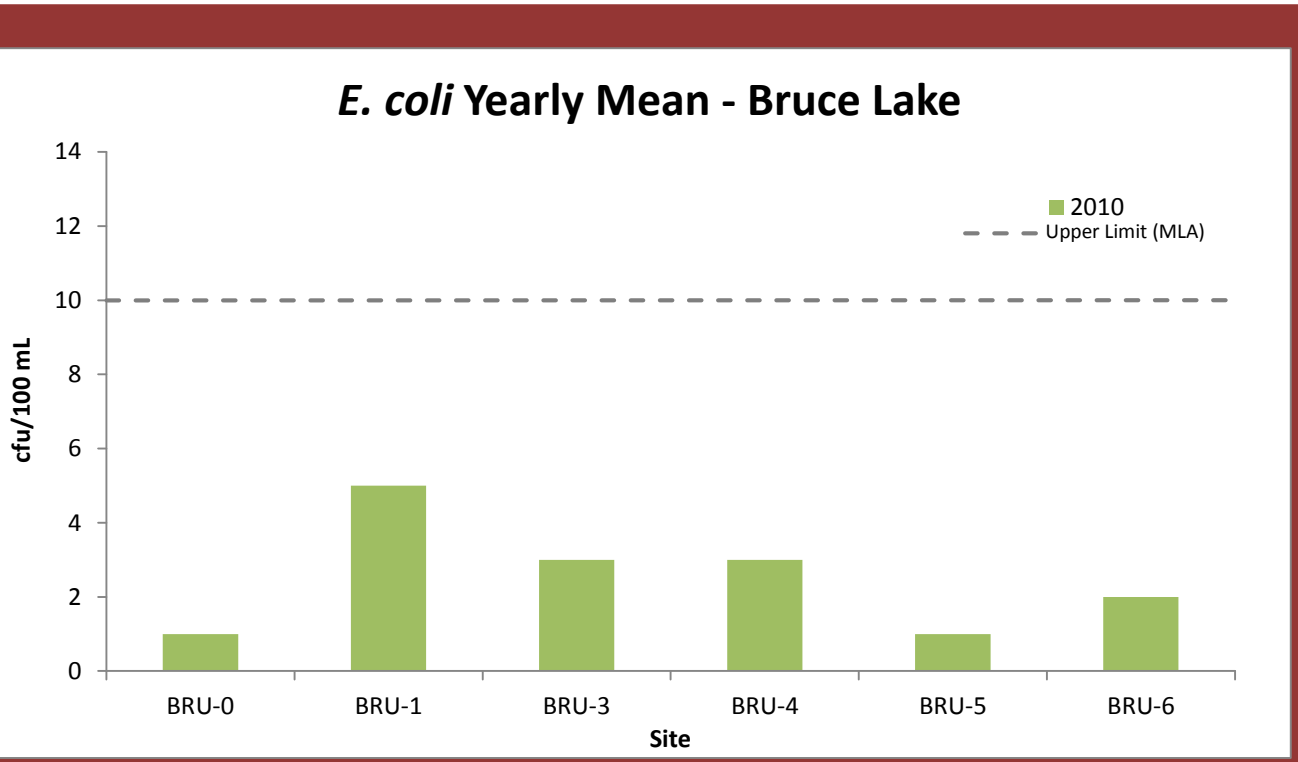
2010 *E. coli* measurements were below the MLA upper limit for all sites.

Comments and/or Recommendations

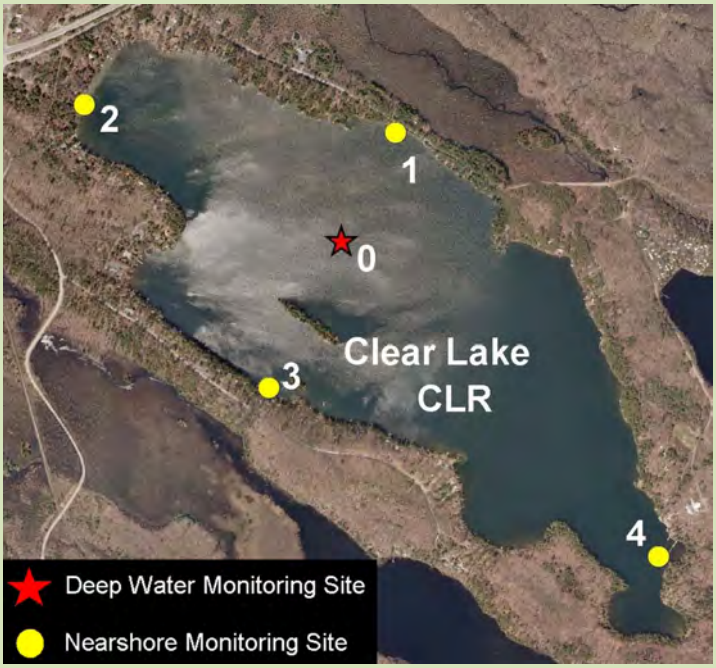
Nearshore sampling did not detect land-based influences on nearshore phosphorus.

(BRU) BRUCE LAKE





CLEAR LAKE (CLR)



Area Description

Clear Lake, also called Torrance Lake, is a moderately developed lake with much of the shoreline area converted into residential lots. It is also adjacent to highway 169. This lake is 152 ha in size, has a maximum depth of 16 m and has a very small watershed. There is limited inflow and outflow of water on this lake. Clear Lake has been classified as moderately sensitive and over threshold by the DMM.

Volunteer Recognition

Clear Lake was monitored in 2010 by **Bob Cleverdon** and **Sharon Cleverdon**.

2010 Data

CLR-0: TP-Spring turnover = 6.9 µg/L
TP-Yearly mean = 5.7 µg/L
Secchi = 7.2 m

CLR-1: TP-Yearly mean = 5.3 µg/L
Total coliforms = 78 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

CLR-2: TP-Yearly mean = 6.7 µg/L
Total coliforms = 20 cfu/100 mL
Total *E. coli* = 1 cfu /100 mL

CLR-3: TP-Yearly mean = 5.0 µg/L
Total coliforms = 36 cfu /100 mL
Total *E. coli* = 1 cfu /100 mL

CLR-4: TP-Yearly mean = 5.4 µg/L
Total coliforms = 56 cfu /100 mL
Total *E. coli* = 4 cfu /100 mL

Trends

Monitoring of Clear Lake started in 2006 and all total phosphorus measurements have been over the threshold value. The 2010 spring turnover and yearly mean values are slightly elevated compared to those observed in 2009.

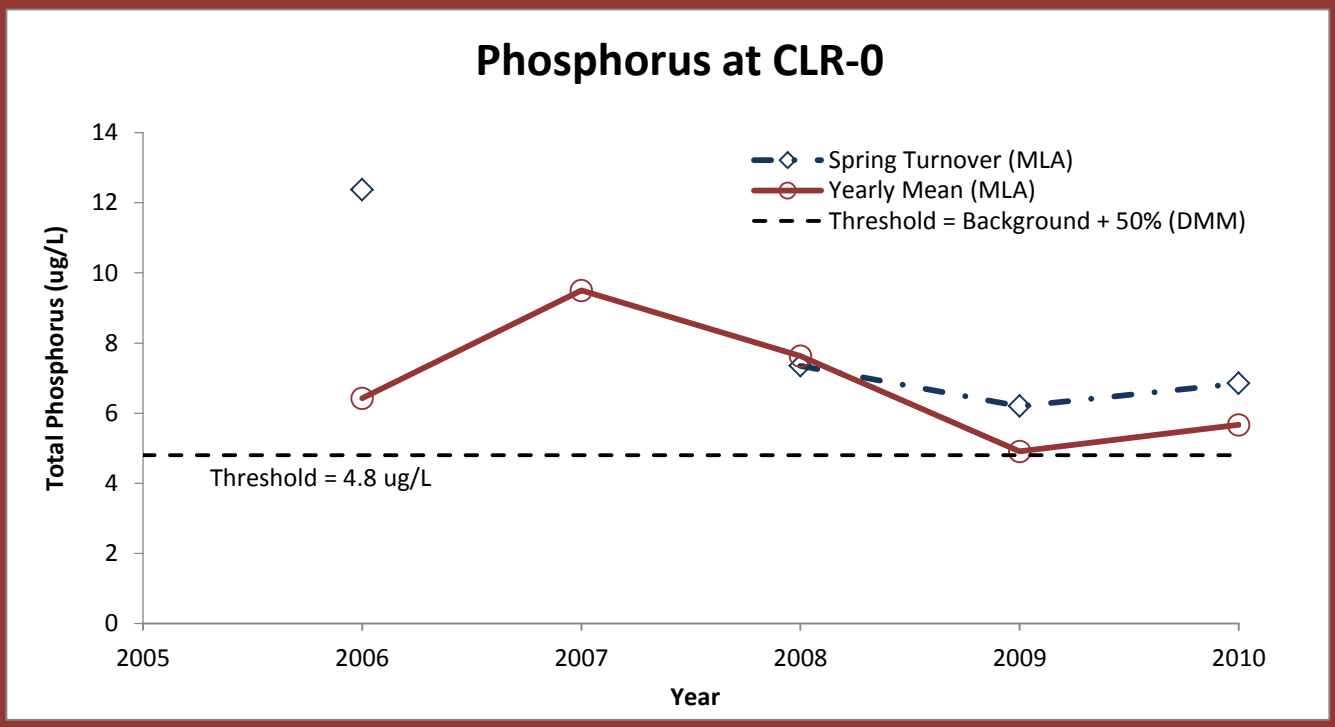
2010 *E. coli* values were relatively low at all sites. Marginal increases over historic ranges were observed at CLR-1 and CLR-4.

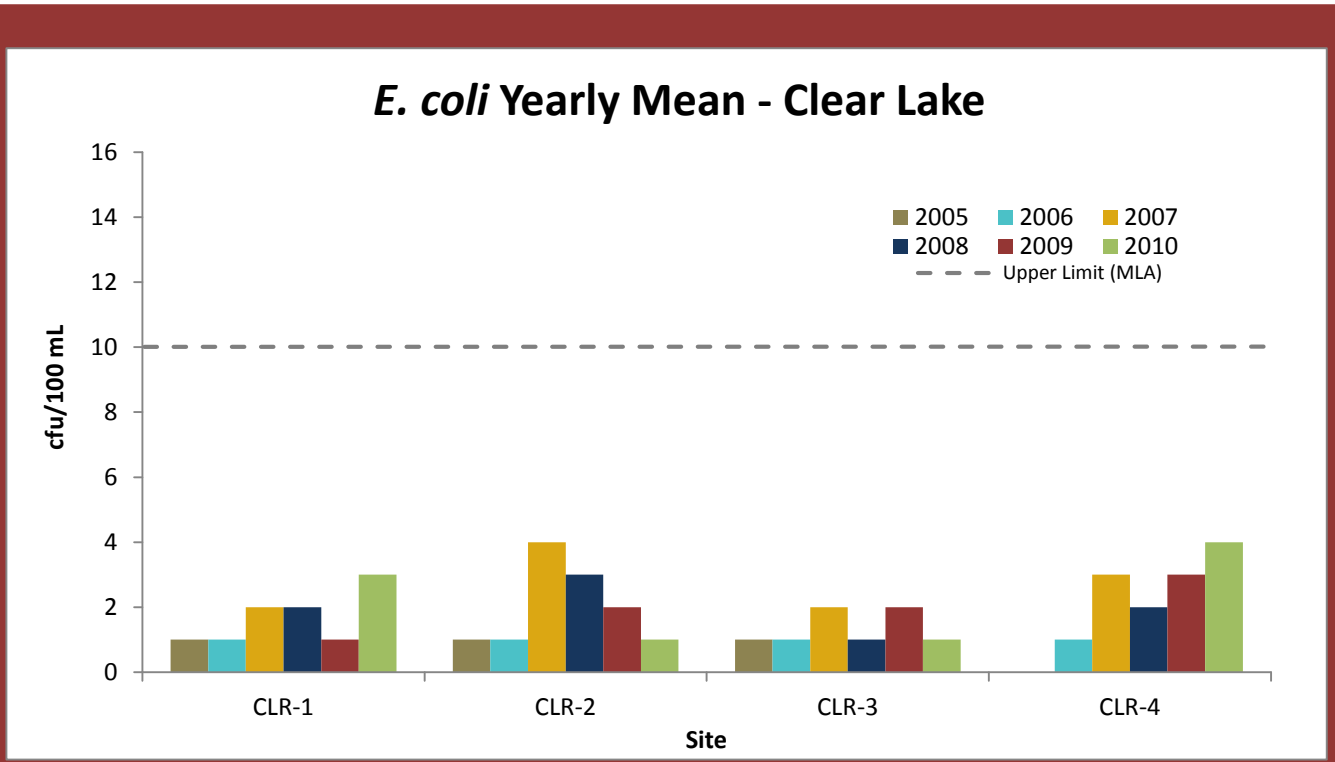
Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

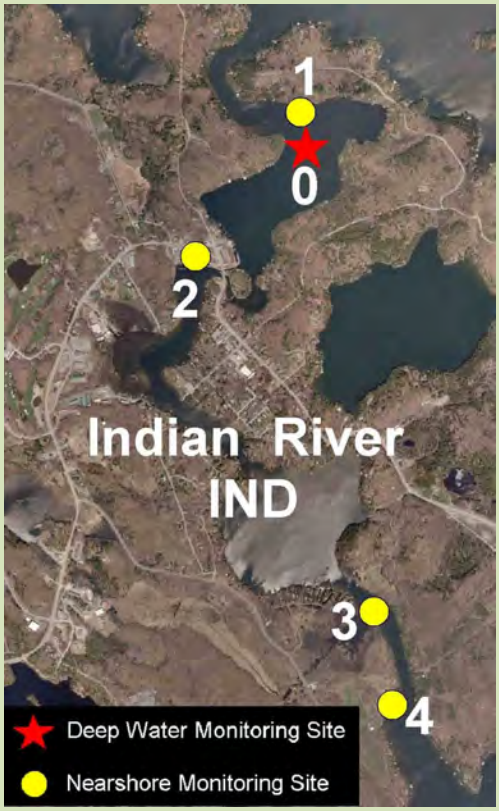
5+ years of sampling has not indicated a bacterial issue; consider discontinuing sampling at CLR-2, 3 and 4 and establishing new sampling sites.

(CLR) CLEAR LAKE





INDIAN RIVER (IND)



Area Description

The Indian River flows from Lake Rosseau, through Port Carling and into Mirror Lake and Lake Muskoka. This highly developed area receives stormwater from the Port Carling urban centre. It also has high boat traffic, a locks system, marinas and many commercial and residential properties. A large lacustrine wetland is located adjacent to the river.

Volunteer Recognition

Indian River was monitored in 2010 by Lindsay Carson, Randy Carson, **Susan Carson**, Rick Spence, Sandy Tozer Spence, Dianne Turnbull, and Ian Turnbull.

2010 Data

IND-0: TP-Spring turnover = 5.4 µg/L
Secchi = 4.5 m
Total coliforms = 15 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

IND-1: Total coliforms = 25 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

IND-2: Total coliforms = 65 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

IND-3: Total coliforms = 139 cfu/100 mL
Total *E. coli* = 20 cfu/100 mL

IND-4: Total coliforms = 95 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

Trends

Monitoring of Indian River started in 2002. Total phosphorus concentrations fluctuated from 2002-2006. Spring turnover phosphorus measurements have remained relatively stable since 2007.

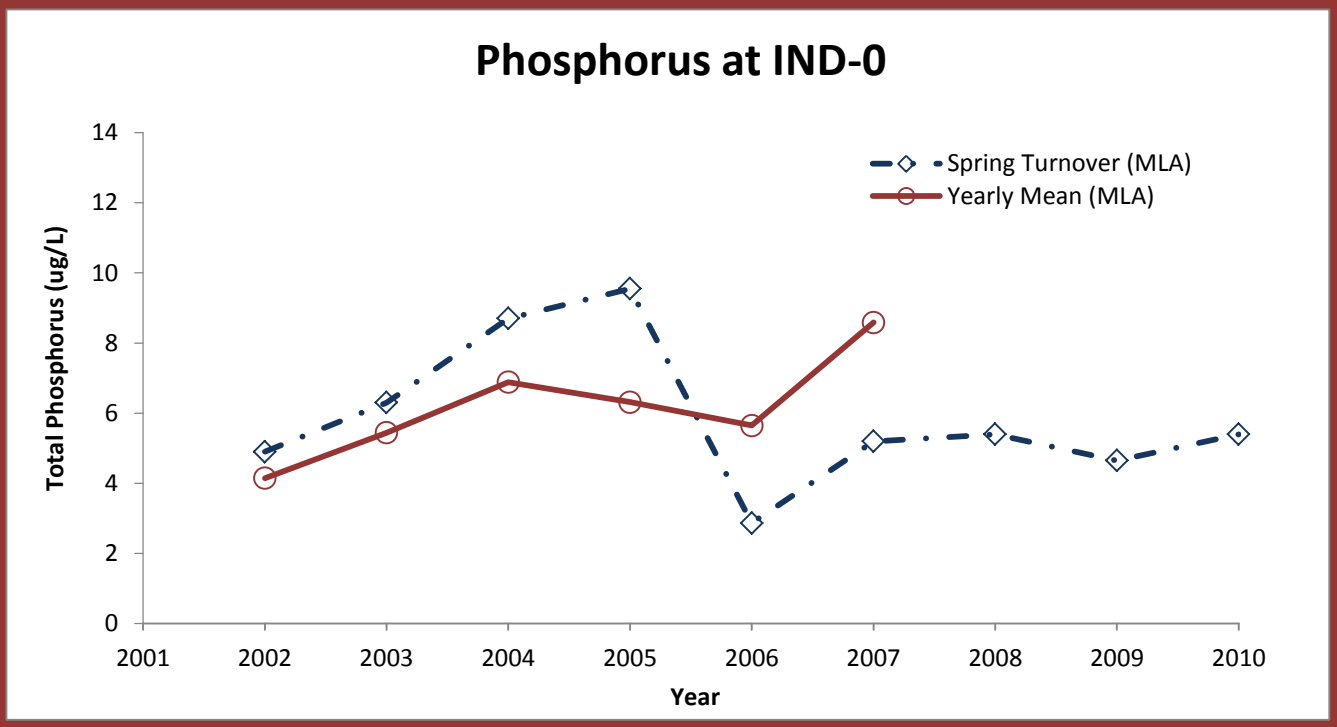
In 2010, *E. coli* levels were highest at IND-3.

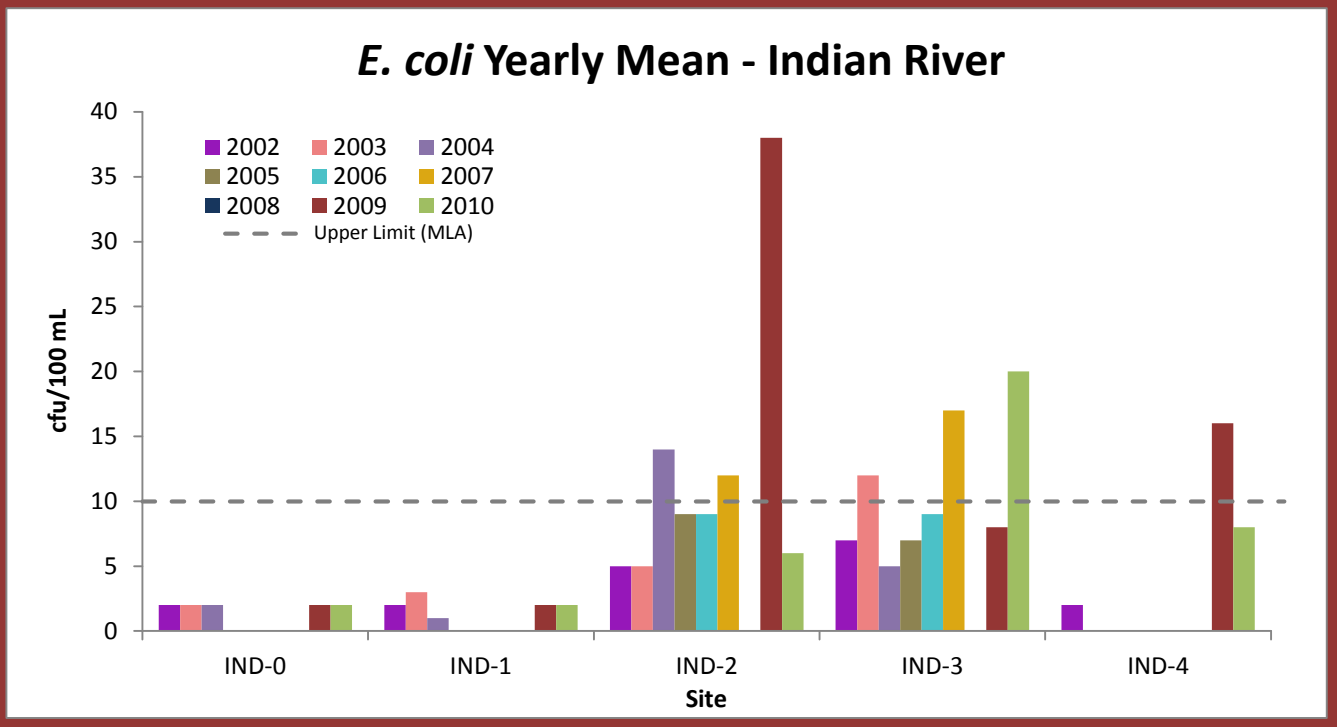
Two of eight *E. coli* measurements at IND-3 were above 50 cfu/100mL (59 and 127).

Comments and/or Recommendations

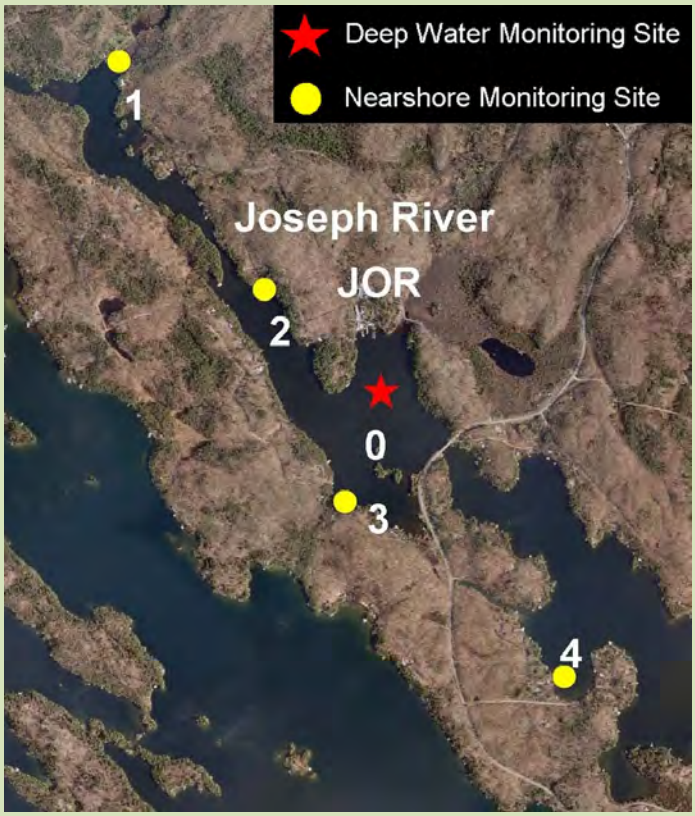
In 2011, provide a detailed description of land use at IND-3 to help determine potential causes of elevated *E. coli* levels.

(IND) INDIAN RIVER





JOSEPH RIVER (JOR)



Area Description

Joseph River is the water body connecting Lake Joseph and Lake Rosseau The river is 1.37 km² in size and up to 8 m deep. Direction of flow is from Lake Joseph into Lake Rosseau. A marina, a bridge crossing for Peninsula Road and two wetlands are located adjacent to the channel. This area receives significant boat traffic as the main navigable waterway between the two large lakes. The Joseph River is classified as moderately sensitive by the DMM.

Volunteer Recognition

Joseph River was monitored in 2010 by Larry Giles and **Beth Guy**.

2010 Data*

JOR-0: TP-Yearly mean = 14.1 µg/L
Secchi = 3.8 m

JOR-1: TP-Yearly mean = 8.5 µg/L

JOR-2: TP-Yearly mean = 15.7 µg/L

JOR-3: TP-Yearly mean = 9.4 µg/L

JOR-4: TP-Yearly mean = 4.7 µg/L

* Samples collected for weekends 5 through 8 only.

The 2010 yearly mean phosphorus value for JOR-0 was skewed due to a measurement of 40.8 µg/L.

Yearly mean phosphorus values for JOR-1, 2 and 3 were also skewed by elevated measurements.

Trends

Monitoring of the Joseph River started in 2005.

Spring turnover phosphorus concentrations were relatively stable over the period of 2005-2008.

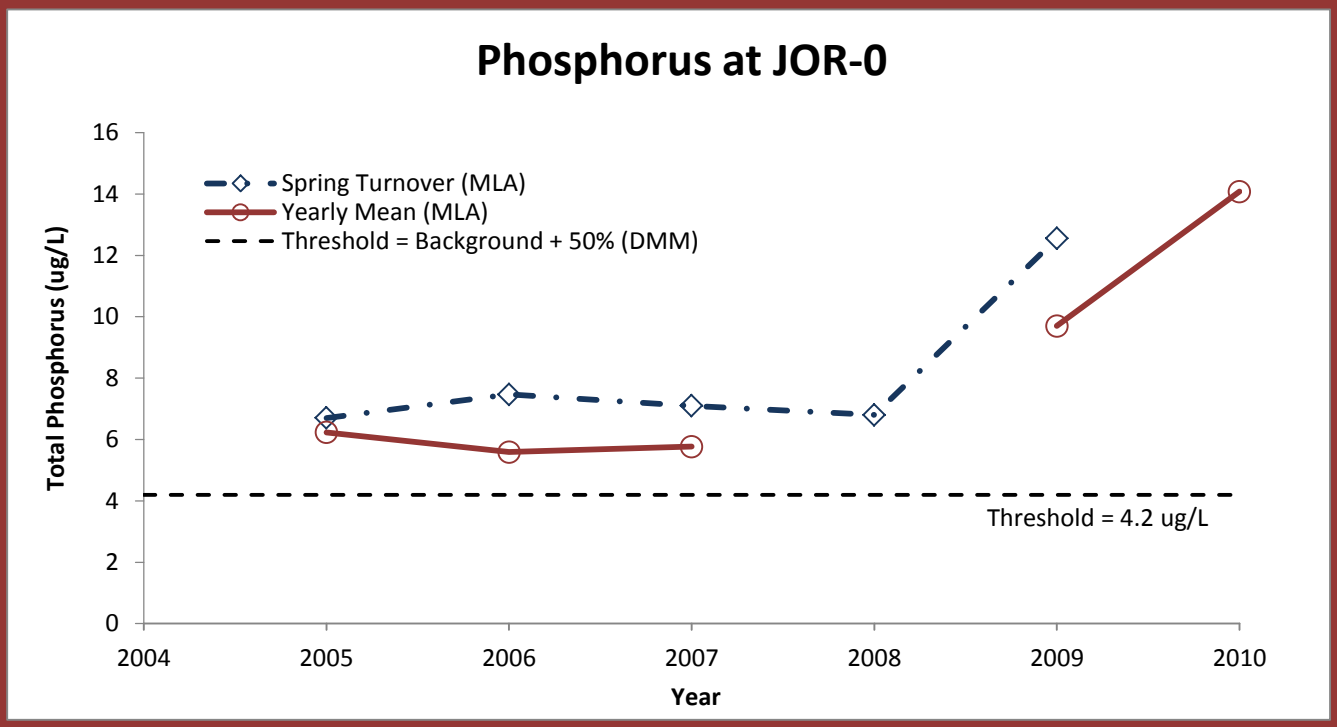
Total coliform and *E. coli* were not monitored in this sampling area.

Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

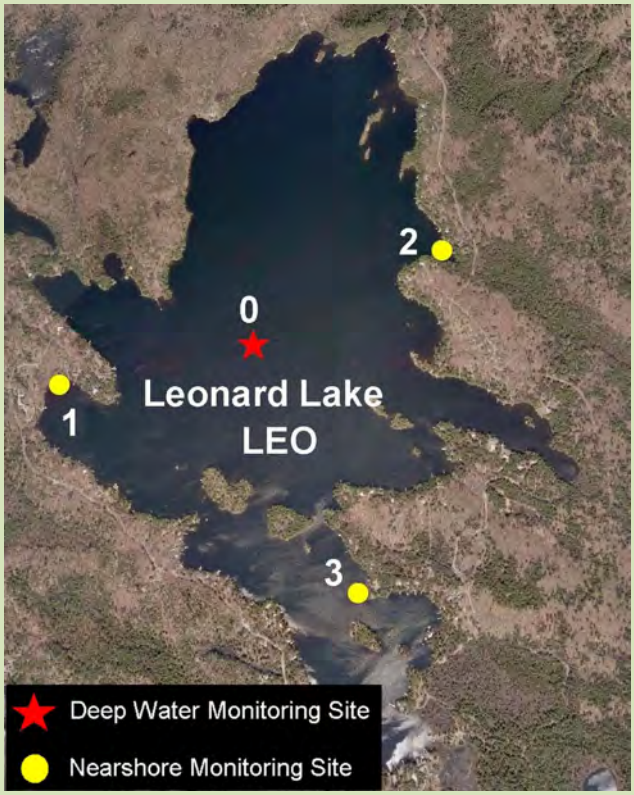
Elevated phosphorus concentrations observed in 2009 and 2010 were possibly due to contaminated samples. Filtering may resolve this issue in 2011.

(JOR) JOSEPH RIVER



Notes:

LEONARD LAKE (LEO)



Area Description

Leonard Lake is a medium sized lake at 1.52 km² in size and has a maximum depth of 16 m. This lake is moderately developed with primarily residential properties. Immediate shoreline alteration is limited to 9% but backlot clearing and forest thinning is found in 77% of properties. There is limited inflow and outflow of water on this lake, and few wetlands in the vicinity. Leonard Lake is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Leonard Lake was monitored in 2010 by **Betty Isbister**, Cole Roberts, **Gordon Roberts**, and Doug Wallace.

2010 Data

LEO-0: TP-Spring turnover = 7.2 µg/L*
TP-Yearly mean = 4.4 µg/L
Secchi = 4.3 m
Total coliforms = 15 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

LEO-1: Total coliforms = 84 cfu/100 mL
Total *E. coli* = 9 cfu/100 mL

LEO-2: Total coliforms = 72 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

LEO-3: Total coliforms = 84 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

* The 2010 sping turnover phosphorus duplicate split was 5.8/8.5 ug/L.

Trends

Monitoring of Leonard Lake started in 2008. From 2008 to 2009, total phosphorus measurements were relatively stable.

2010 *E. coli* values were equal to or above historic site maximums, however none were above the MLA upper limit.

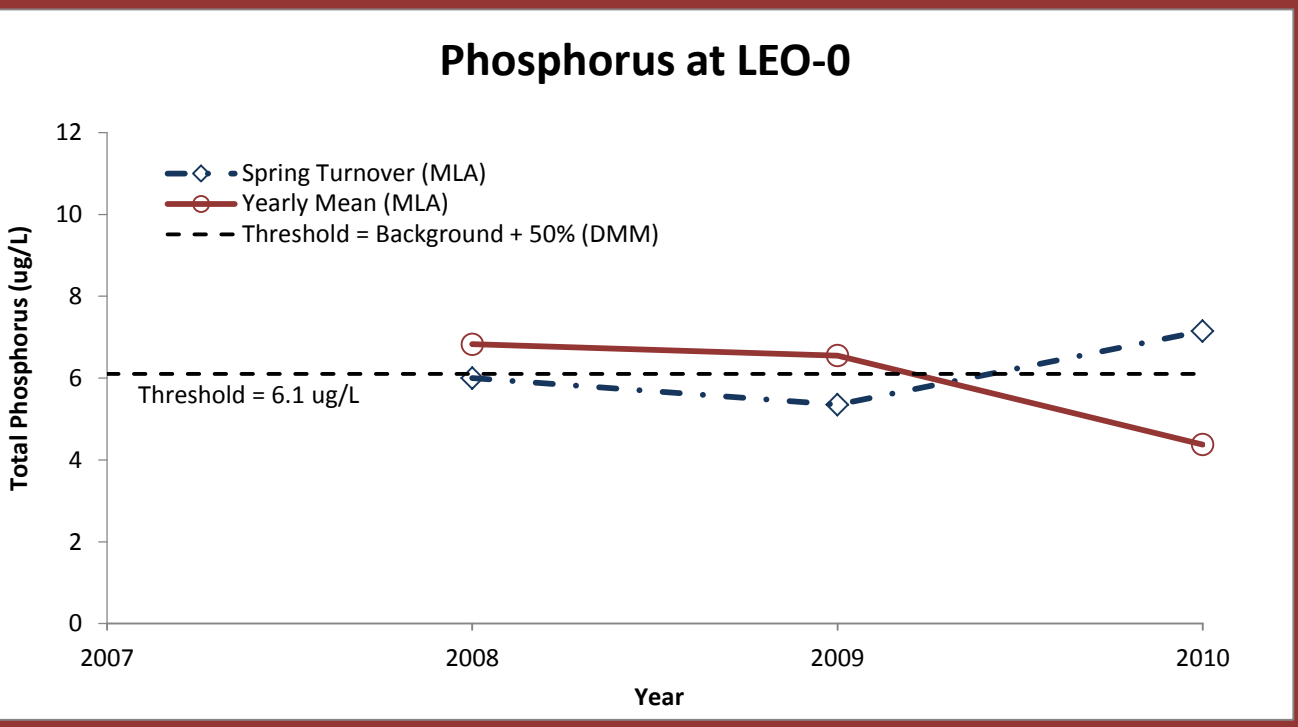
Comments and/or Recommendations

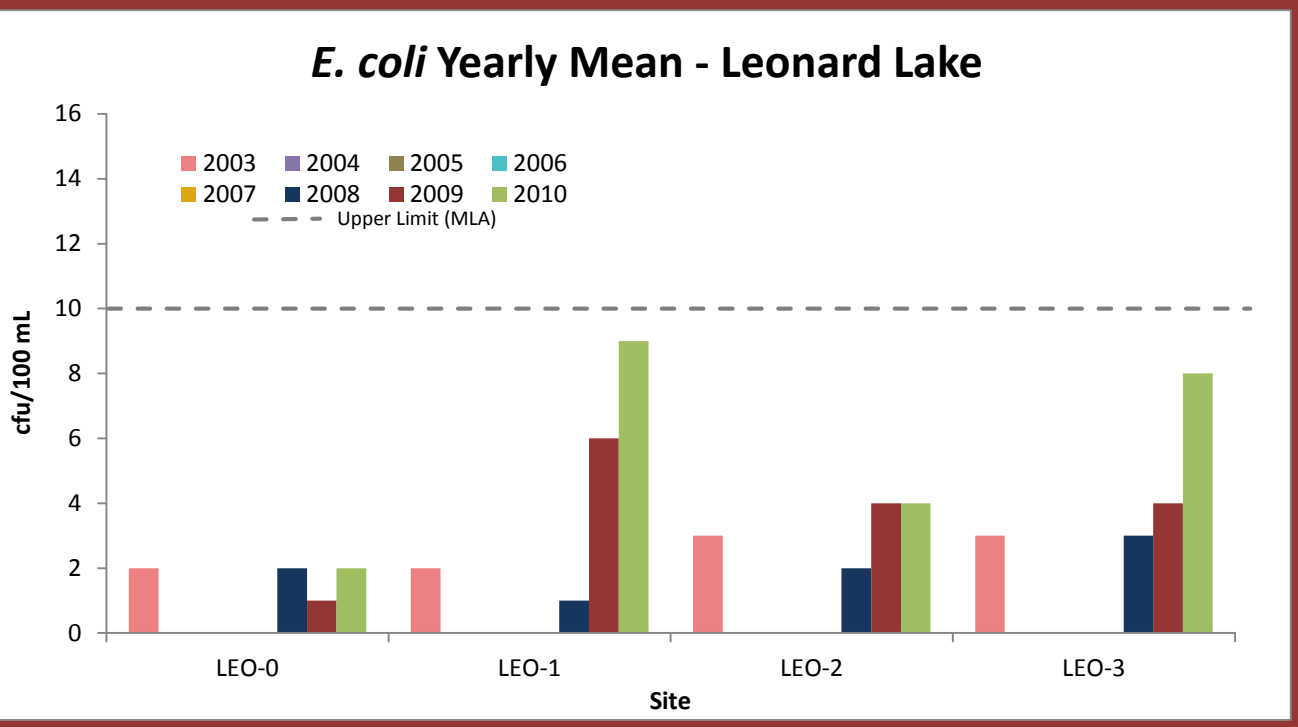
Consider reviewing the extent of back lot clearing to determine potential for impact on phosphorus levels.

Invertebrate data from Site 1 in 2005, 2006 and 2010 indicates no change in the benthic community over time and that water conditions are consistent with the Muskoka average.

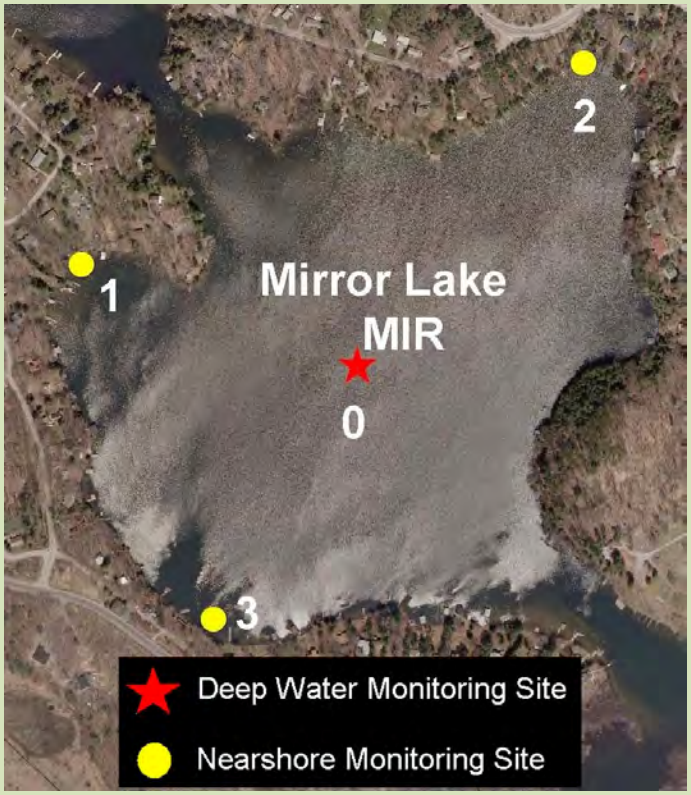
3 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at LEO-2 and establishing a new sampling site.

(LEO) LEONARD LAKE





MIRROR LAKE (MIR)



Area Description

Mirror Lake is essentially a widening of the Indian River as it flows between Lake Rosseau to the north and Lake Muskoka to the south. The lake is approximately 0.46 km² in area, with a maximum depth of 8 m. Two small creeks outlet into the lake near sampling sites MIR-1 and MIR-2. Much of the lake is within the Town of Port Carling and receives drainage from the urban area. Mirror Lake has a small watershed, approximately 0.97 km², and is classified as moderately sensitive and over-threshold by the DMM.

Volunteer Recognition

Mirror Lake was monitored in 2010 by Randy Carson, **Susan Carson**, Carly Spence, Jennifer Spence, Rick Spence, and Sandy Tozer Spence.

2010 Data

MIR-0: TP-Spring turnover = 6.7 µg/L
TP-Yearly mean = 5.1 µg/L
Secchi = 3.3 m
Total coliforms = 35 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

MIR-1: TP-Yearly mean = 7.7 µg/L
Total coliforms = 89 cfu/100 mL
Total *E. coli* = 12 cfu/100 mL

MIR-2: TP-Yearly mean = 8.2 µg/L
Total coliforms = 93 cfu/100 mL
Total *E. coli* = 10 cfu/100 mL

MIR-3: TP-Yearly mean = 8.8 µg/L
Total coliforms = 73 cfu/100 mL
Total *E. coli* = 6 cfu/100 mL

Trends

Monitoring of Mirror Lake started in 2007. Since then, yearly mean total phosphorus concentrations have trended downward while the spring turnover concentrations have remained relatively stable.

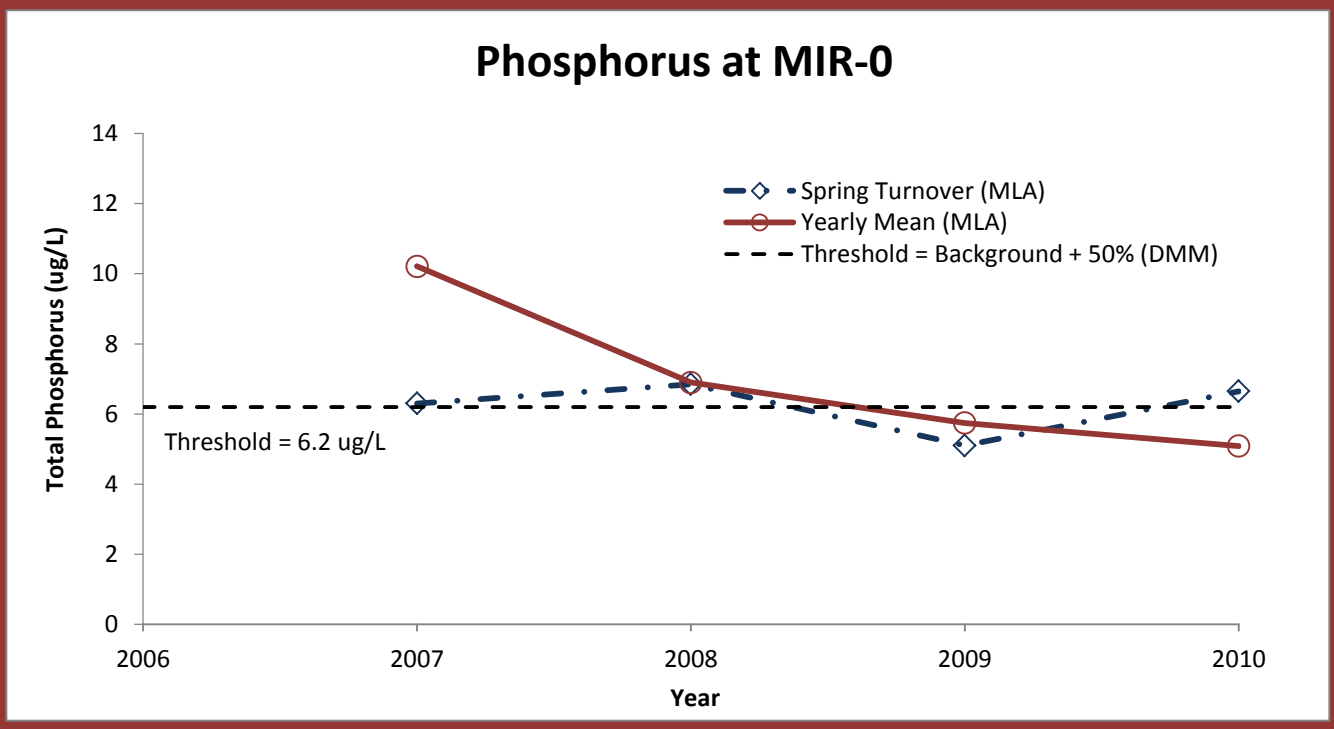
2010 *E. coli* levels in Mirror Lake were much lower than those observed in 2009, however levels at MIR-1 and MIR-2 reached the MLA upper limit.

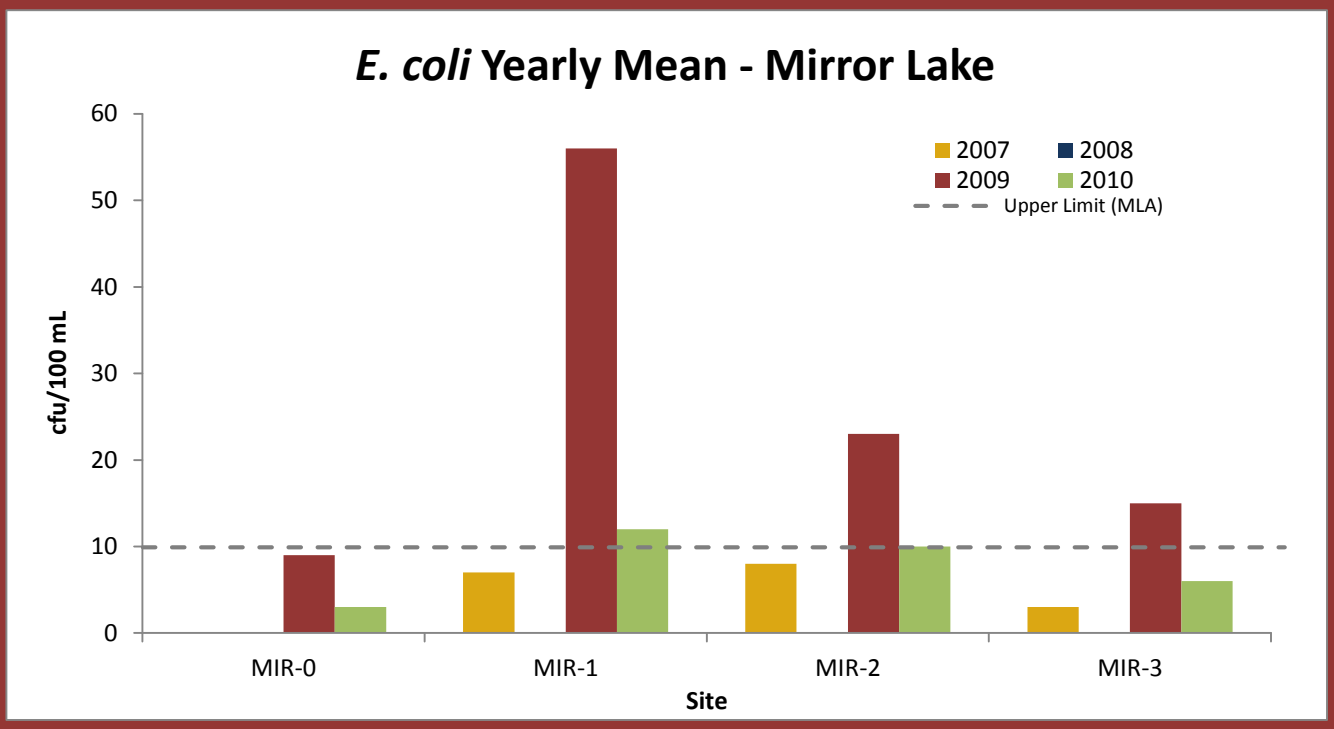
Comments and/or Recommendations

Nearshore sampling did not detect land-based influences on nearshore phosphorus.

Detailed land use descriptions should be collected for the nearshore *E. coli* sites based on high levels found in the Indian River system as compared to the main lake sites.

(MIR) MIRROR LAKE





MOON RIVER (MOO)

Area Description

The Moon River is the main outlet of the Muskoka Watershed, flowing from Lake Muskoka to Georgian Bay. The river receives overland drainage from the Town of Bala and its urban area, including many roads and the developed shoreline. Approximately 12 creeks outlet into this sampling area, several draining wetlands.

Volunteer Recognition

Moon River was monitored in 2010 by Allen & Jane Bossin, Bruce & Nancy Calder, Simon Dwyer, Peter Hemming, Bob McTavish, Paul & Tara Murphy, Anne & **Bruno Polewski**, Bill Purkis and Carolyn Sullivan.

2010 Data

MOO-1: TP-Spring turnover = 5.1 µg/L
TP-Yearly mean = 5.9 µg/L
Secchi = 4.0 m
Total coliforms = 29 cfu/100 mL
Total *E. coli* = 11 cfu/100 mL

MOO-3: TP-Yearly mean = 5.0 µg/L
Total coliforms = 29 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MOO-4: Total coliforms = 55 cfu/100 mL
Total *E. coli* = 12 cfu/100 mL

MOO-5: Total coliforms = 19 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MOO-6: Total coliforms = 51 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

MOO-7: Total coliforms = 16 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

MOO-8: Total coliforms = 32 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

MOO-9: Total coliforms = 26 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

Trends

Monitoring of the Moon River started in 2005.

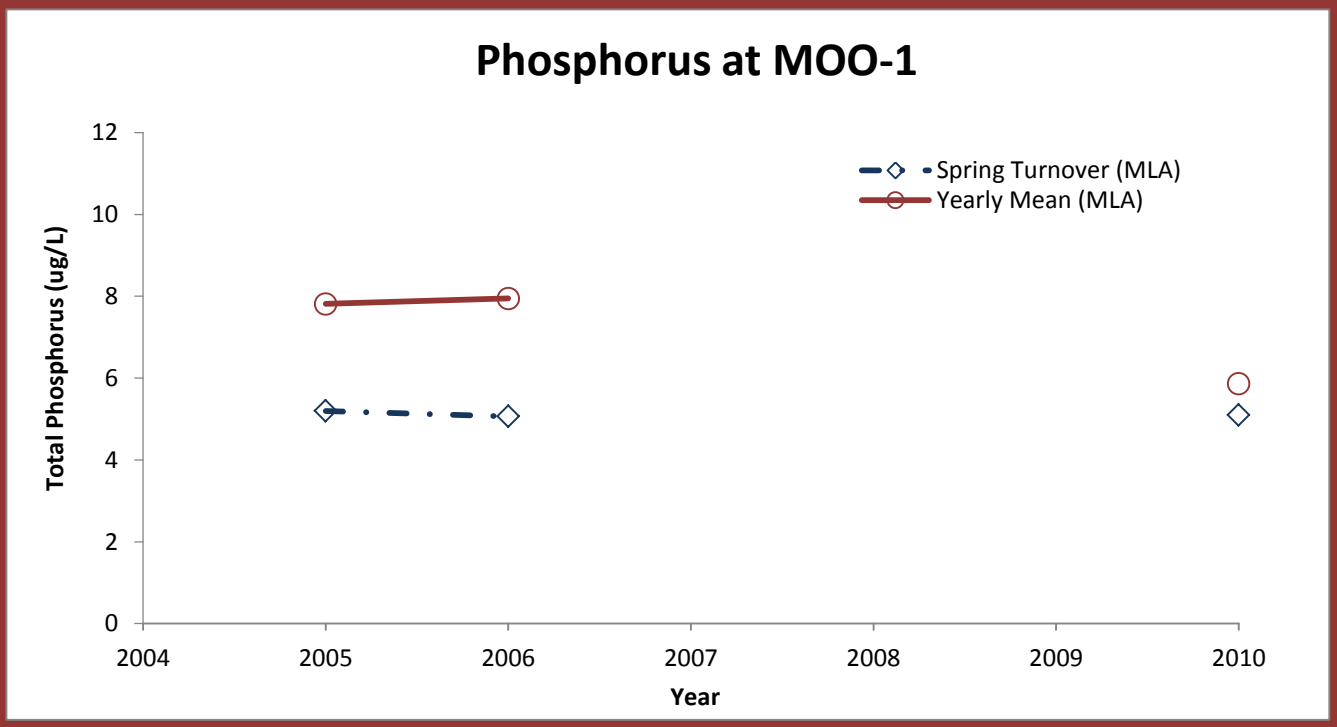
In 2010, *E. coli* levels at MOO-1 and MOO-4 were elevated compared to previous years, each falling above the MLA upper limit.

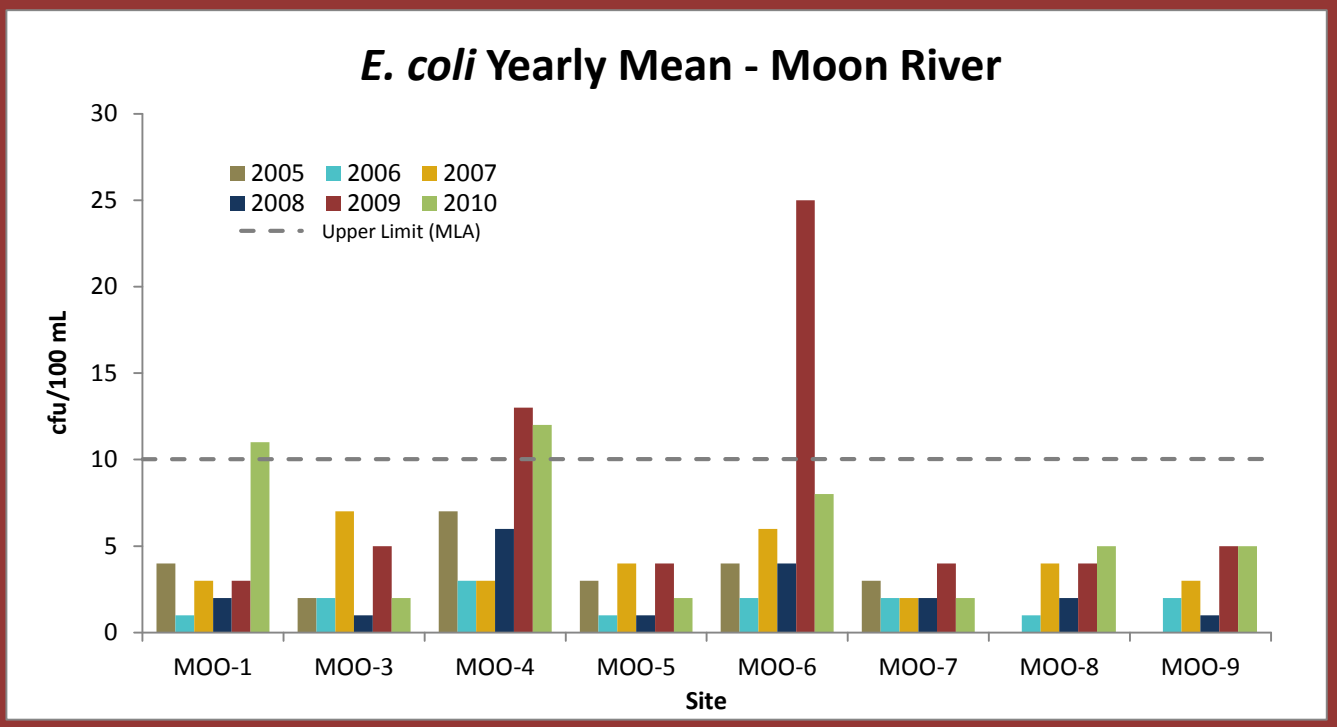
Comments and/or Recommendations

Continue sampling spring turnover phosphorus to monitor long-term trends.

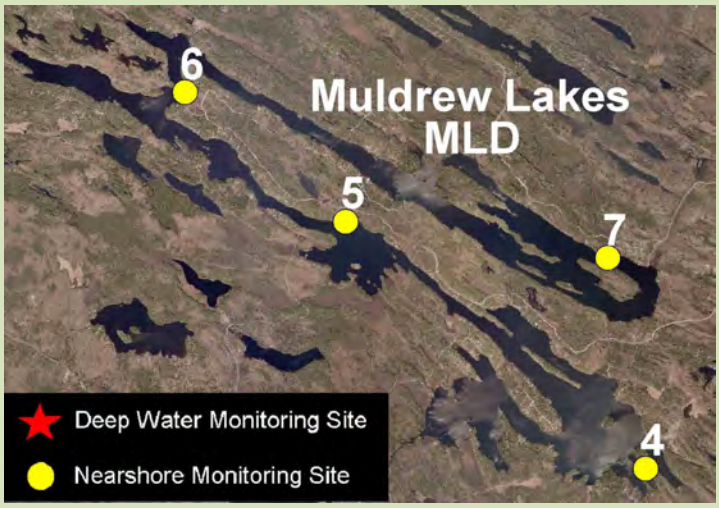
In 2011, document land use adjacent to MOO-4 and MOO-6 to help determine potential sources of *E. coli*.

(MOO) MOON RIVER





MULDREW LAKES (MLD)



Volunteer Recognition

Muldrew Lakes was monitored in 2010 by **Lola Bratty**, **Micheal Foster**, John Twist and Joanne Twist.

Area Description

North and South Muldrew Lakes are oriented northwest to southeast, formed as a result of glacial retreat. North Muldrew Lake is approximately 1.52 km² in size, a maximum of 16 m deep and is considered moderately sensitive by the DMM. Several creeks and five wetland areas drain into the lake. There is a large resort area along the eastern shoreline and considerable residential development, most retaining a natural shoreline. South Muldrew Lake is approximately 2.7 km² in area, with a maximum depth of 18 m, and is also classified as moderately sensitive. South Muldrew Lake has less shoreline development than North Muldrew Lake, likely due to the extent of adjacent wetlands. Approximately ten wetland areas drain into the eastern portion of South Muldrew Lake.

2010 Data

MLD-4: Total coliforms = 78 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

MLD-5: Total coliforms = 120 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

MLD-6: Total coliforms = 55 cfu/100 mL
Total *E. coli* = 1 cfu/100 mL

MLD-7: Total coliforms = 34 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of bacteria in Muldrew Lakes started in 2007. Since then, *E. coli* levels have remained relatively consistent.

There has been a steady decrease in *E. coli* levels at site MLD-7 over the period of 2007-2010.

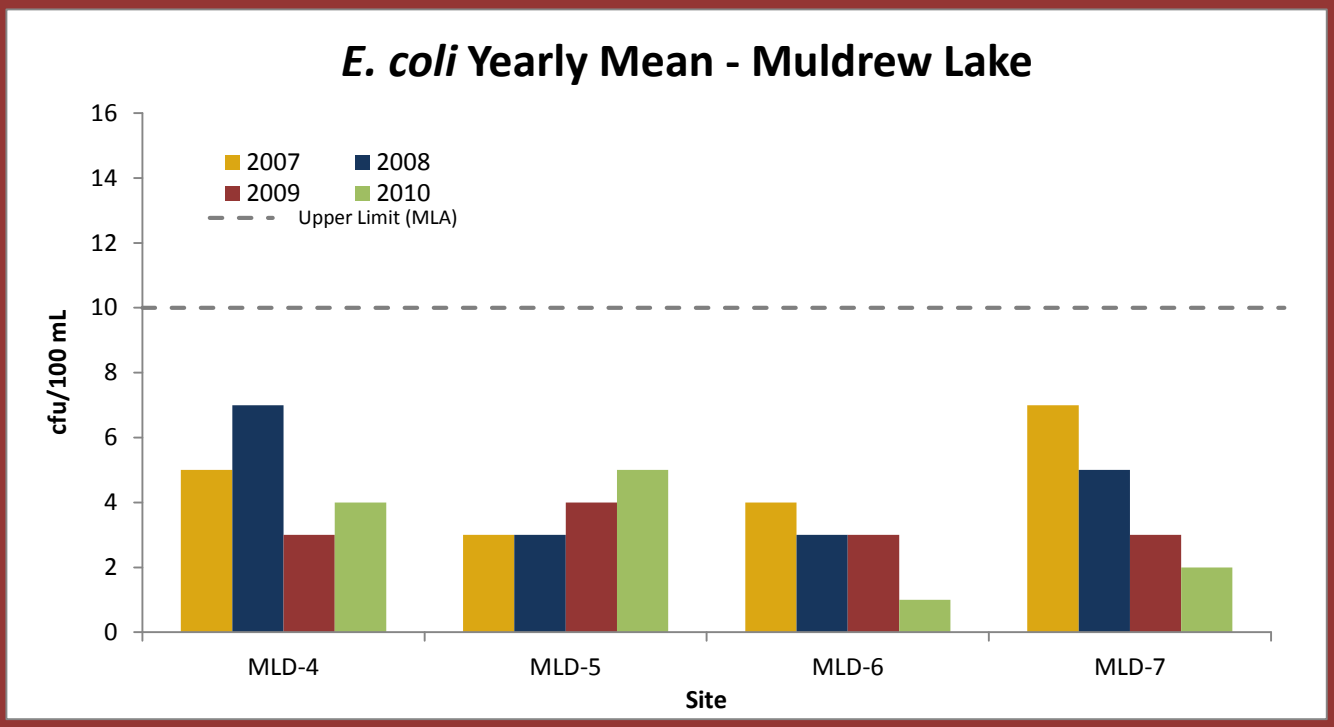
Total phosphorus was not monitored in this sampling area for 2010.

Comments OR Recommendations

Consider locating *E. coli* sampling sites in areas of high human use and rotate sites every few years to cover more of the lake.

Maintain one control site for long-term monitoring.

(MLD) MULDREW LAKES



Notes:

MUSKOKA RIVER (MRV)

Area Description

This sample area includes the most downstream reach of the Muskoka River where it flows from the Town of Bracebridge to Allport Bay, Lake Muskoka. This area is highly developed on both banks, and includes the Bracebridge urban area, large agricultural fields, and extensive residential properties along the entire reach of shoreline. Roads are located along both sides of the river for most of the reach length. Several creeks outlet into the river through this area, and there are limited wetland areas adjacent to the river.

Volunteer Recognition

Muskoka River was monitored in 2010 by Debbie Hastings and **John Wood**.

2010 Data

MRV-1: TP-Spring turnover = 6.6 µg/L
Secchi = 3.5 m
Total coliforms = 162 cfu/100 mL
Total *E. coli* = 8 cfu/100 mL

MRV-2: TP-Spring turnover = 6.7 µg/L
Total coliforms = 152 cfu/100 mL
Total *E. coli* = 15 cfu/100 mL

MRV-3: TP-Spring turnover = 6.7 µg/L
Sechhi = 3.5 m
Total coliforms = 157 cfu/100 mL
Total *E. coli* = 21 cfu/100 mL

MRV-4: TP-Spring turnover = 6.8 µg/L
Total coliforms = 179 cfu/100 mL
Total *E. coli* = 22 cfu/100 mL

MRV-5: TP-Spring turnover = 23.5 µg/L*
TP-Yearly mean = 19.6 µg/L
Secchi = 1.6 m

*No duplicate spring turnover sample collected.

Trends

Monitoring of the Muskoka River started in 2003 and includes sites from the Town of Bracebridge to Lake Muskoka. From 2008-2010, spring turnover phosphorus concentrations at MRV-1 have been trending downward.

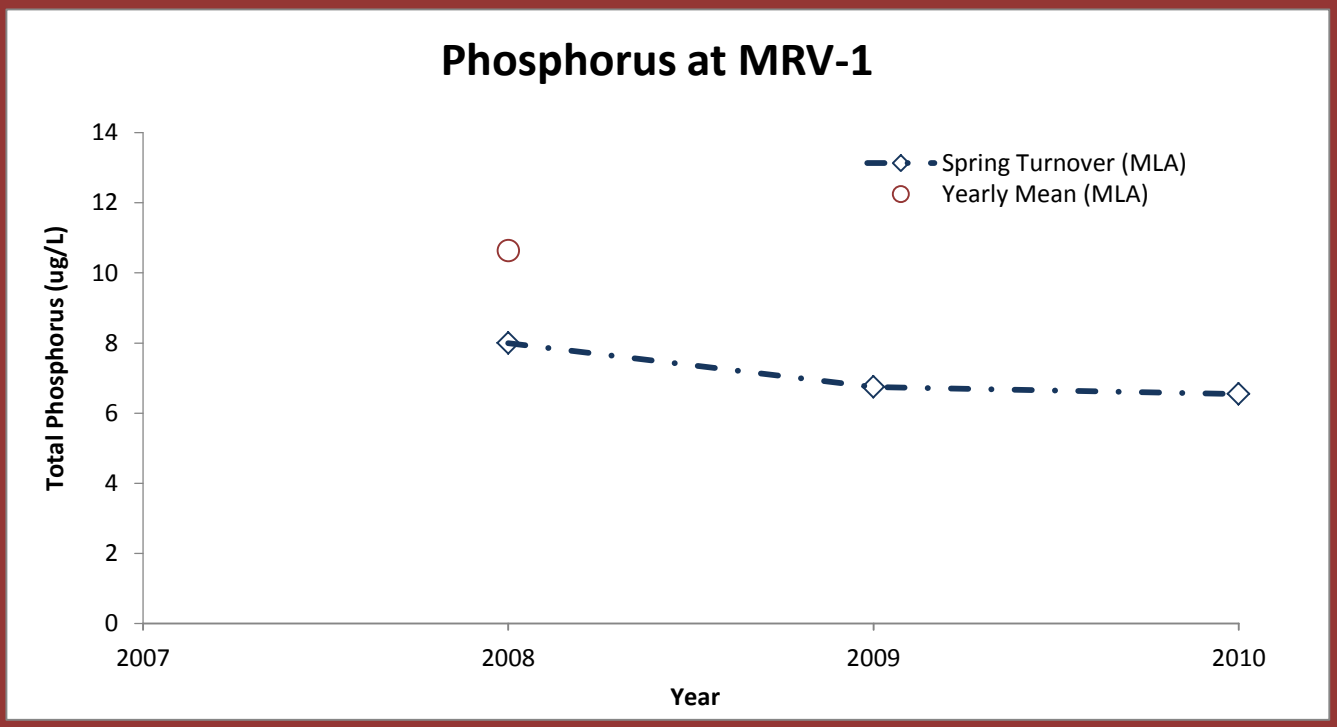
As was the case in several years prior, 2010 *E. coli* numbers at MRV-2, MRV-3 and MRV-4 were above the MLA upper limit.

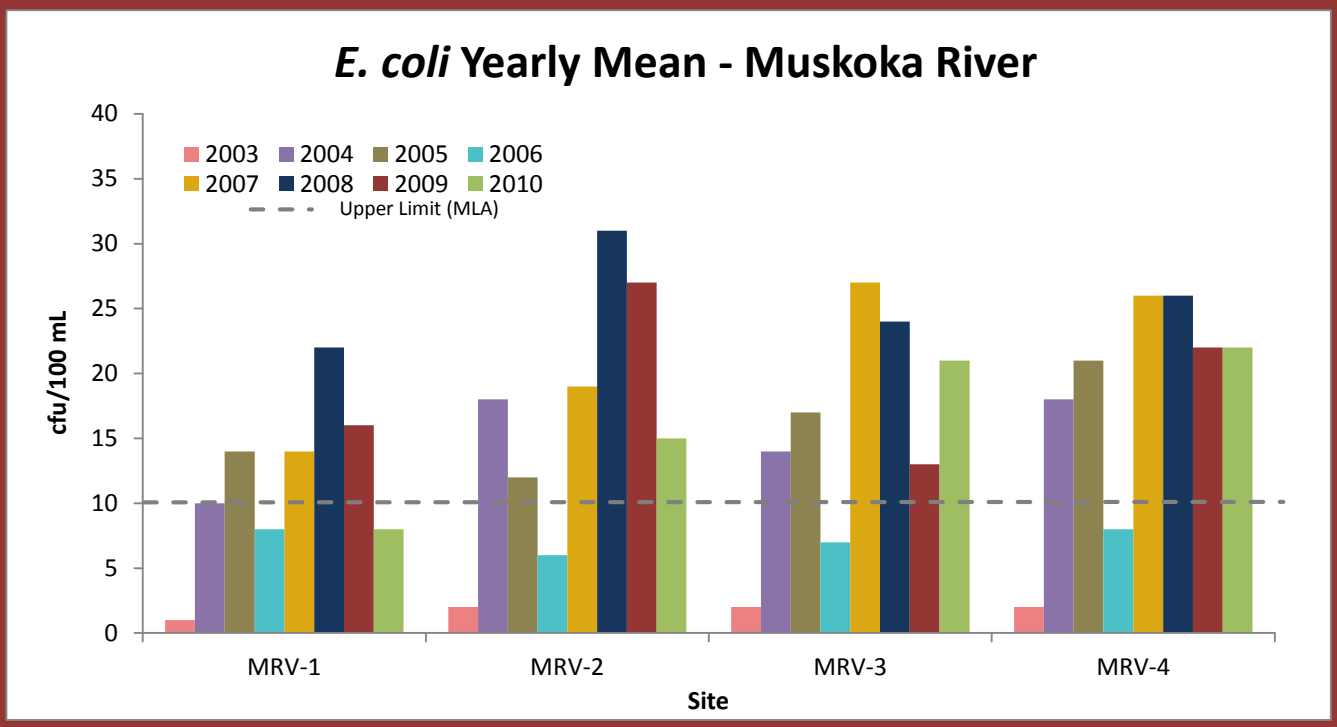
Comments and/or Recommendations

Nearshore sampling at MRV-5 suggests potential land-based influences on nearshore phosphorus. This site is at the mouth of Beaver Creek. In 2011, an additional site should be added to determine phosphorus levels within the creek.

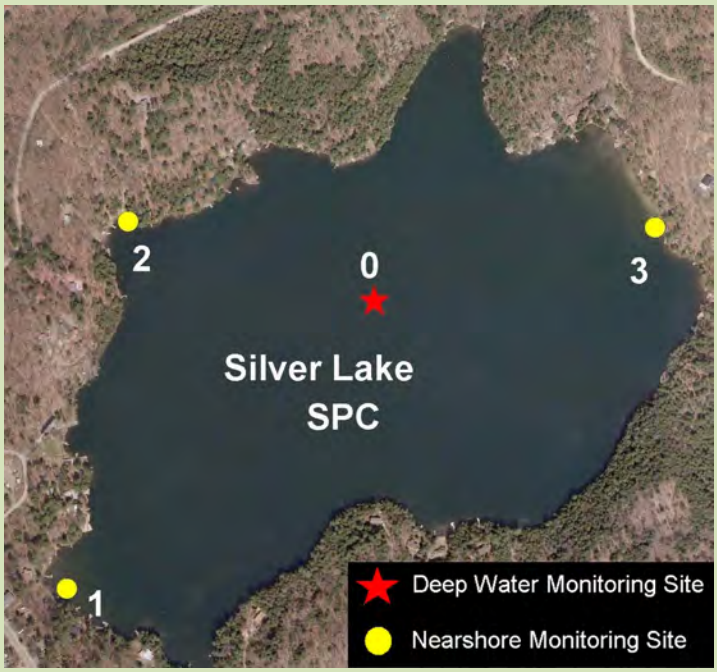
An additional bacterial sampling site should be established upstream of the Town of Bracebridge to help determine baseline conditions.

(MRV) MUSKOKA RIVER





SILVER LAKE (SPC)



Area Description

Silver Lake is immediately adjacent to Port Carling, with 0.57 km² in surface area and a maximum depth of 14 m. This lake has a moderate amount of shoreline residential development with alteration in the form of lawns and thinned forest occurring over approximately 50% of the upland area. The riparian area is well buffered with 90% of the immediate shoreline in a natural state. The southwestern portion of this lake receives drainage from part of the Port Carling urban area. There is limited flow into the lake with one identified outlet in the south. Silver Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Silver Lake was monitored in 2010 by **Perry Bowker**, Megan Edwards, Owen Edwards, Stephanie Sher, and Jason Stephenson.

2010 Data

SPC-0: TP-Spring turnover = 6.8 µg/L
TP-Yearly mean = 6.5 µg/L
Secchi = 4.5 m

SPC-1: Total coliforms = 25 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

SPC-2: Total coliforms = 40 cfu/100 mL
Total *E. coli* = 7 cfu/100 mL

SPC-3: Total coliforms = 16 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

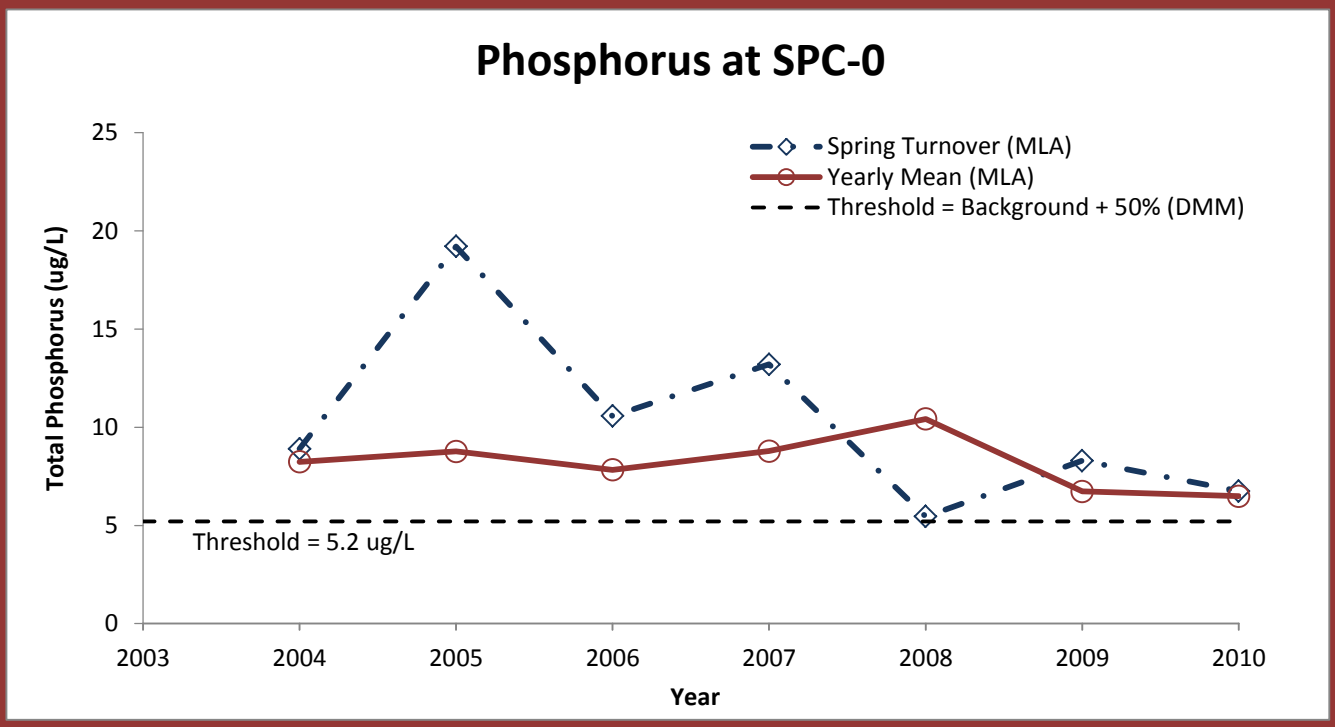
Monitoring of Silver Lake started in 2004. Since then, spring turnover phosphorus concentrations have fluctuated, trending slightly downward. Yearly means have remained relatively stable over this period. All recorded phosphorus concentrations have been above the threshold value.

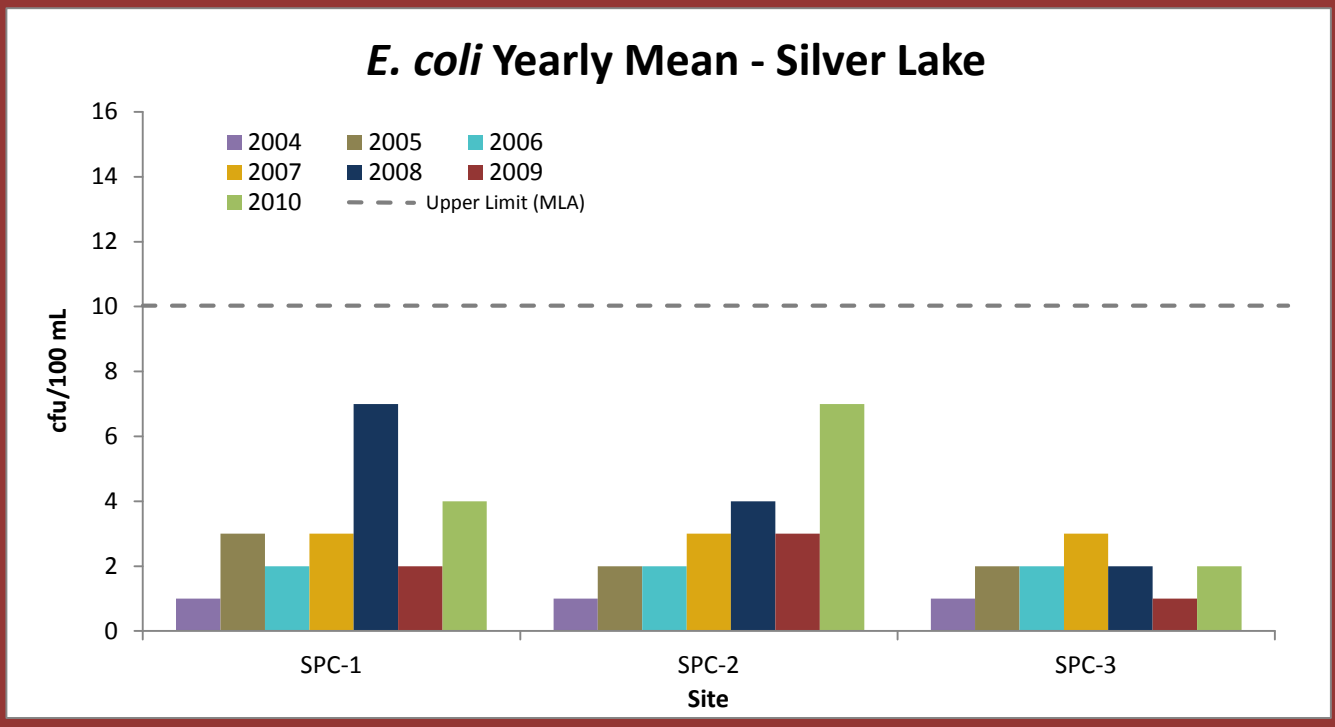
In 2010, *E. coli* levels were below the MLA upper limit at all 3 sites. Slightly higher bacteria levels were observed at SPC-2.

Comments and/or Recommendations

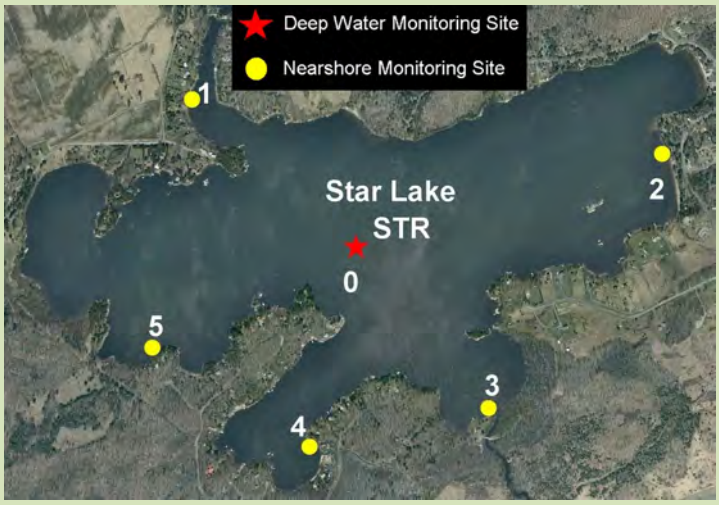
7 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at SPC-1 and SPC-3 and establishing new sampling sites. Focus bacterial sampling on high use areas.

(SPC) SILVER LAKE





STAR LAKE (STR)



Area Description

Star Lake is located in the Township of Seguin and is approximately 158 ha in area with a maximum depth of 23 m. This lake has a moderate to high level of shoreline development in the form of residential properties. Many of these properties maintain natural riparian vegetation along their shorelines, but some have extensive clearings and lawns. There is a large agricultural area adjacent to the northwestern shore and several roads located in close proximity to the lake. This lake has several inflow and outflow creeks, with limited wetland areas in the upper watershed.

Volunteer Recognition

Star Lake was monitored in 2010 by Brice, Esme & Jill Engleman, **Karen Gillies**, Kate & Neil Gillies, Peter Mokriy, Sara Slater, Daniel, Elaine, Emm, Lauren & Will Thurner, Sabrina Timpano, and Jessica Weich.

2010 Data

STR-0: TP-Spring turnover = 7.8 µg/L
Secchi = 2.9 m

STR-1: Total coliforms = 67 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

STR-2: Total coliforms = 56 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

STR-3: Total coliforms = 103 cfu/100 mL
Total *E. coli* = 14 cfu/100 mL

STR-4: Total coliforms = 65 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

STR-5: Total coliforms = 99 cfu/100 mL
Total *E. coli* = 3 cfu/100 mL

Trends

Monitoring of Star Lake started in 2007. Since then, spring turnover phosphorus concentrations have fluctuated with 2007 and 2010 results being below the threshold value.

In 2010, *E. coli* levels were generally low compared to the previous two years of sampling.

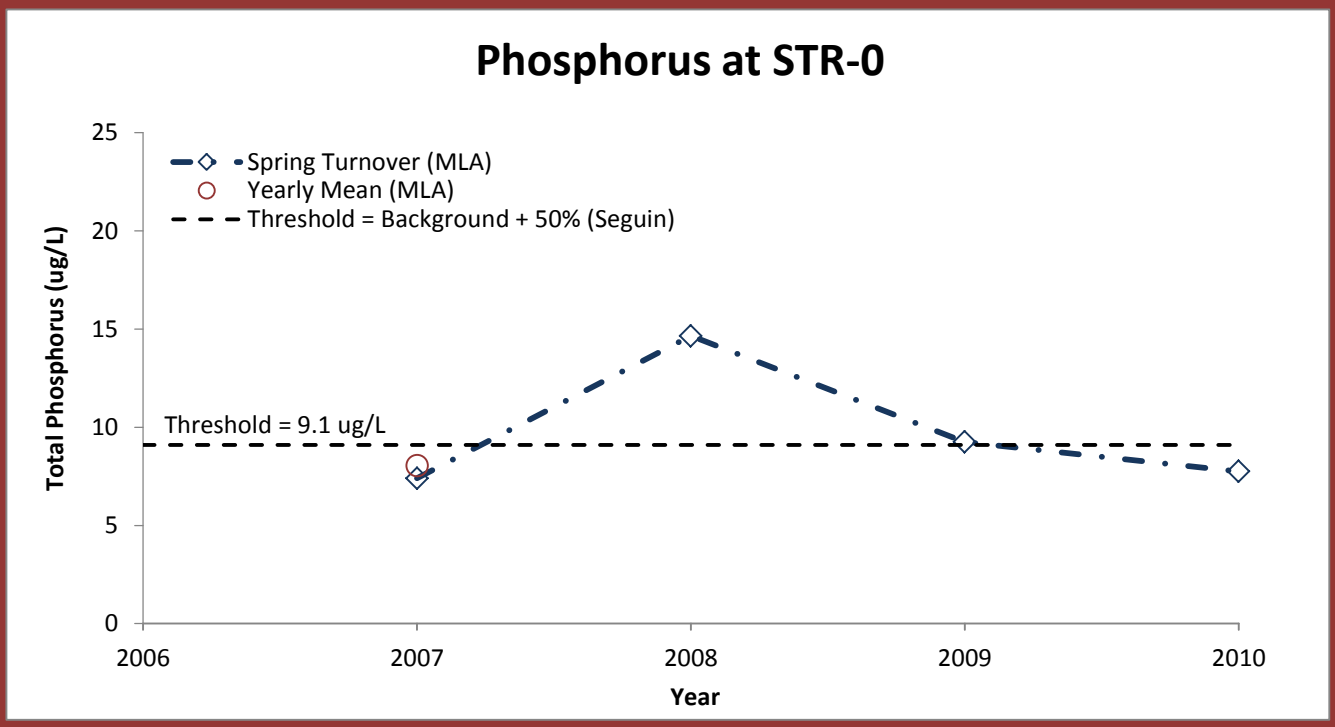
Bacteria levels at STR-3 were higher than at other sites, with *E. coli* being over the MLA upper limit.

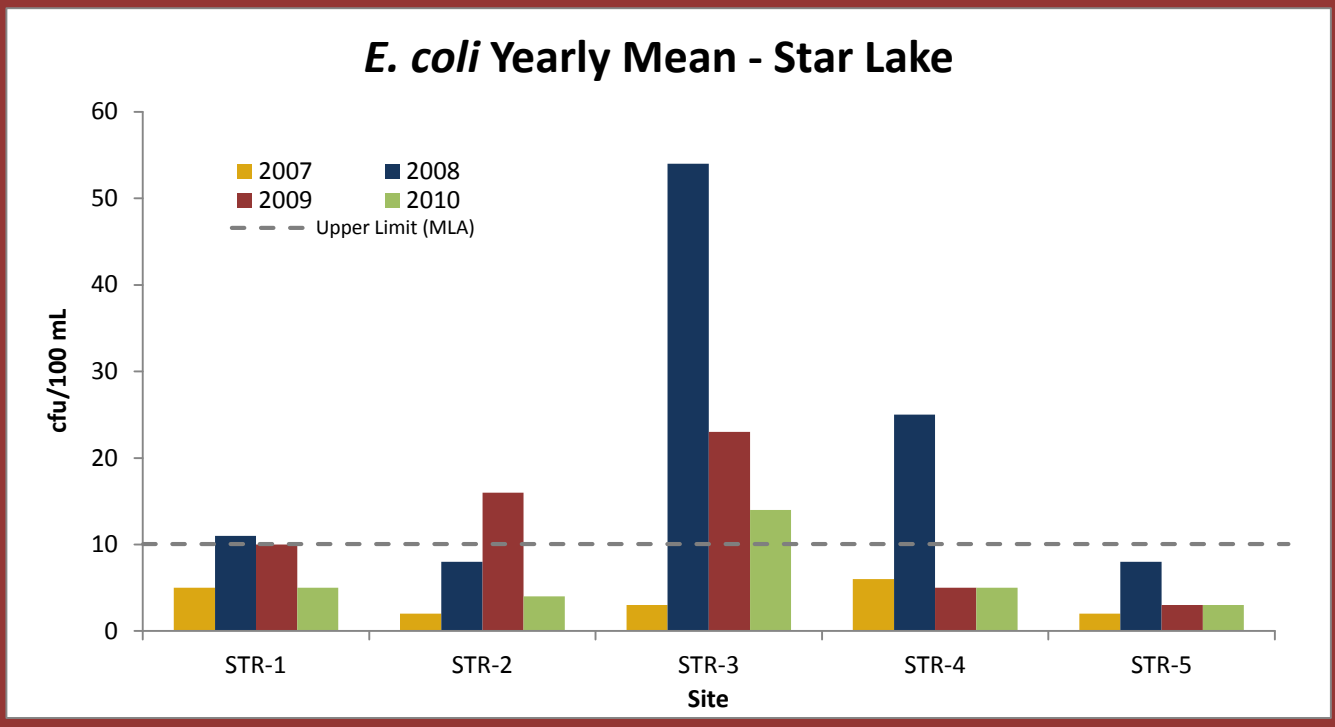
Comments and/or Recommendations

Elevated bacteria levels observed at STR-3 are likely due to the influence of the adjacent watercourse.

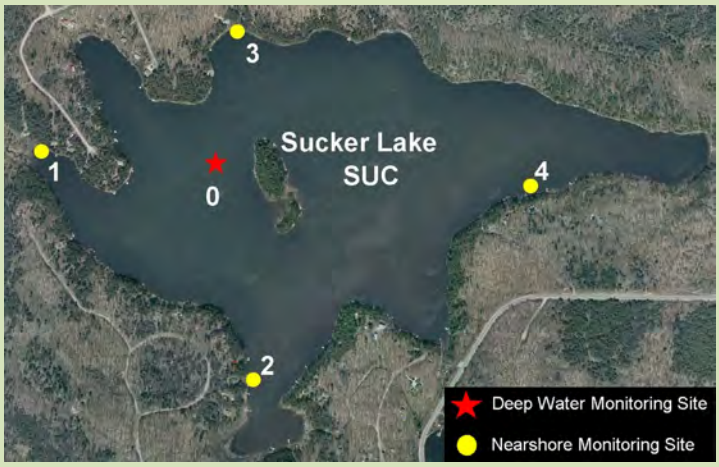
4 years of sampling has not indicated a bacterial issue; consider discontinuing sampling at STR-5 and establishing a new sampling site.

(STR) STAR LAKE





SUCKER LAKE (SUC)



Area Description

Sucker Lake is a medium-sized lake that drains into Lake Rosseau, in the Township of Seguin. This lake has low shoreline development intensity, and the riparian area is well vegetated. There are several creeks that drain into the lake, including those with wetland areas. A few roads are constructed in close proximity to the shoreline, including District Road 632 connecting Rosseau and Minett

Volunteer Recognition

Sucker Lake was monitored in 2010 by **Greg Clarkson**, Gail Haber and Randy Haber.

2010 Data

SUC-0: TP-Spring turnover = 3.9 µg/L
Secchi = 3.5 m

SUC-1: Total coliforms = 317 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SUC-2: Total coliforms = 326 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SUC-3: Total coliforms = 232 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

SUC-4: Total coliforms = 377 cfu/100 mL
Total *E. coli* = 2 cfu/100 mL

Trends

Monitoring of Sucker Lake started in 2009. Spring turnover phosphorus concentrations have trended downward over the period of 2009-2010, with the 2010 value falling below the threshold value.

In 2010, *E. coli* levels at all of the monitored sites were relatively low and well below the MLA upper limit.

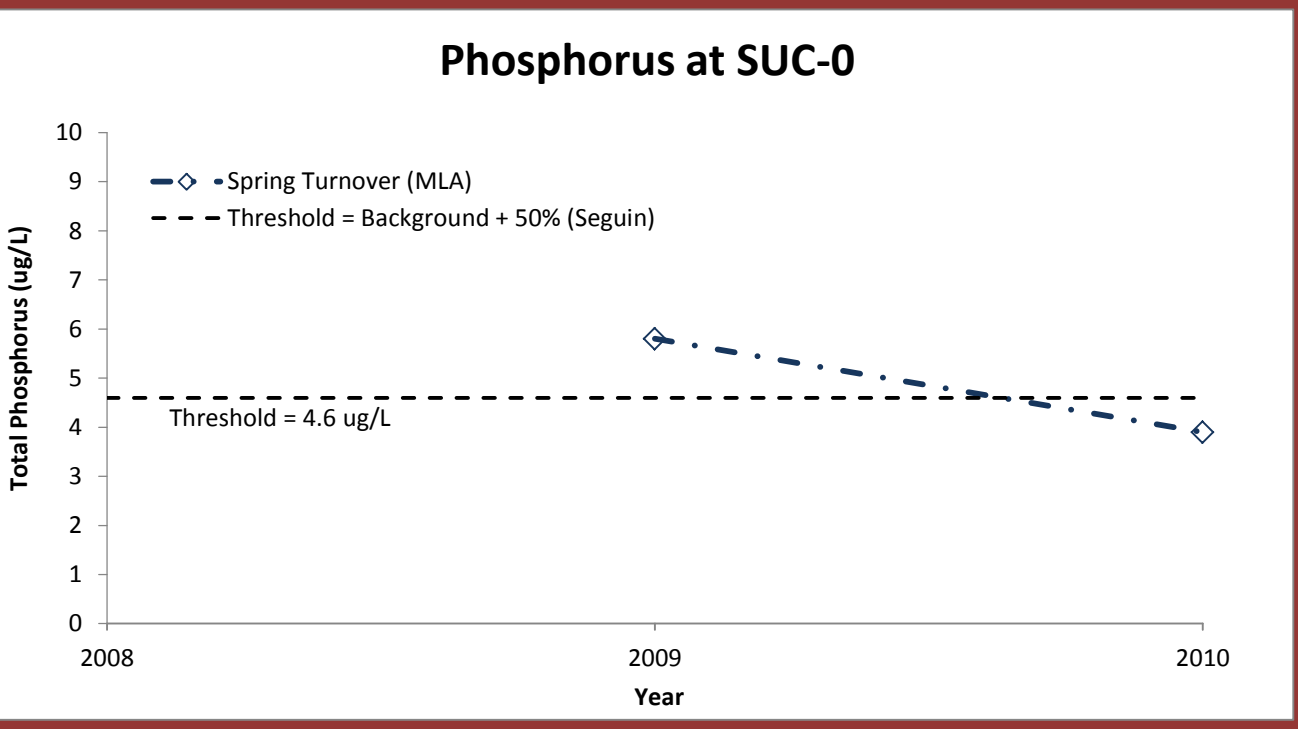
As was the case in 2009, total coliform levels were genearlly higher than expected for lakes in Muskoka.

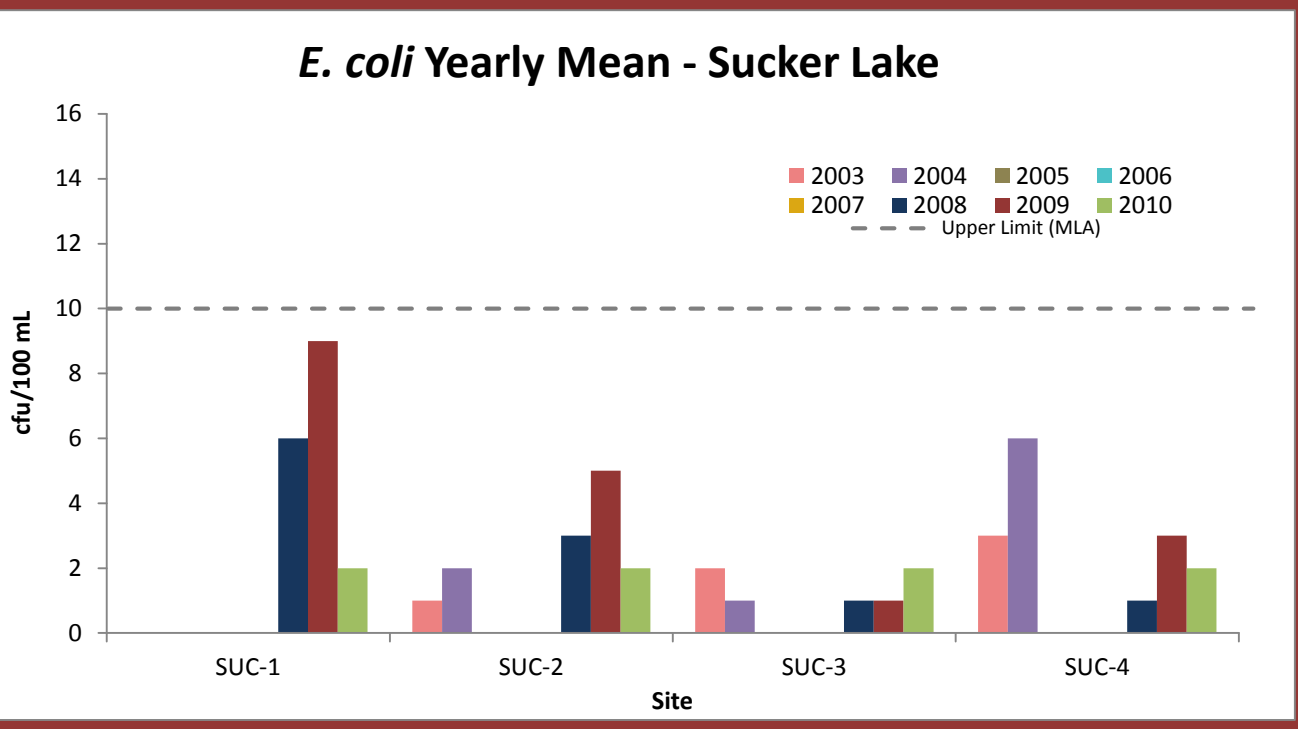
Comments and/or Recommendations

Continue monitoring spring turnover phosphorus.

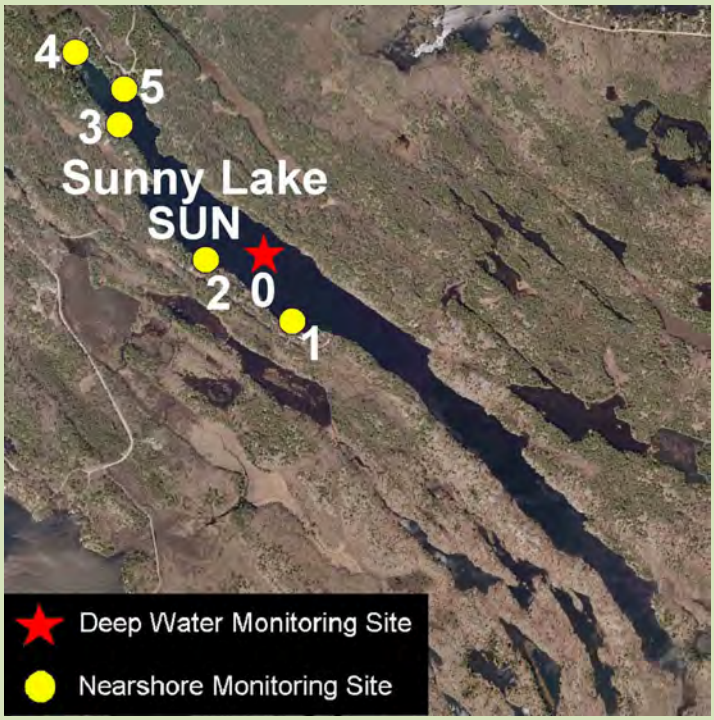
3+ years of sampling has not indicated a bacterial issue; consider discontinuing sampling at SUC-1, 2, 3, and 4 and establishing new sampling sites.

(SUC) SUCKER LAKE





SUNNY LAKE (SUN)



Area Description

Sunny Lake is a long, narrow lake located east of the Town of Gravenhurst, formed as a result of glacial retreat. The lake is approximately 0.5 km² in area, has a maximum depth of 14 m and is part of the Sparrow Lake watershed. The north end of the lake is moderately developed whereas the south end is largely undeveloped. Sunny Lake is classified as moderately sensitive by the DMM.

Volunteer Recognition

Sunny Lake was monitored in 2010 by Enno Hoekstra, Drew Kivell, and **Gordon Sinclair**.

2010 Data

SUN-0: TP-Spring turnover = 11.5 µg/L
Secchi = 2.5 m

SUN-1: Total coliforms = 107 cfu/100 mL
Total *E. coli* = 5 cfu/100 mL

SUN-4: Total coliforms = 109 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

SUN-5: Total coliforms = 128 cfu/100 mL
Total *E. coli* = 4 cfu/100 mL

Trends

Monitoring of Sunny Lake started in 2008 and resumed in 2010. Spring turnover phosphorus concentrations were near the threshold value each year, with the 2010 measurement being slighty higher.

2010 *E. coli* levels were higher than those observed in 2008, however they remained below the MLA upper limit.

Comments and/or Recommendations

Continue sampling spring turnover phosphorus to monitor long-term trends.

If possible, focus *E. coli* sampling in high use areas.

(SUN) SUNNY LAKE